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 NEWS  2           "Ask CAS" for self-help around the clock
 NEWS  3  SEP 09   CA/CAplus records now contain indexing from 1907 to the
                   present
 NEWS  4  DEC 08   INPADOC: Legal Status data reloaded
 NEWS  5  SEP 29   DISSABS now available on STN
 NEWS  6  OCT 10   PCTFULL: Two new display fields added
 NEWS  7  OCT 21   BIOSIS file reloaded and enhanced
 NEWS  8  OCT 28   BIOSIS file segment of TOXCENTER reloaded and enhanced
 NEWS  9  NOV 24   MSDS-CCOHS file reloaded
 NEWS 10  DEC 08   CABA reloaded with left truncation
 NEWS 11  DEC 08   IMS file names changed
 NEWS 12  DEC 09   Experimental property data collected by CAS now available
                   in REGISTRY
 NEWS 13  DEC 09   STN Entry Date available for display in REGISTRY and CA/CAplus
 NEWS 14  DEC 17   DGENE: Two new display fields added
 NEWS 15  DEC 18   BIOTECHNO no longer updated
 NEWS 16  DEC 19   CROPU no longer updated; subscriber discount no longer
                   available
 NEWS 17  DEC 22   Additional INPI reactions and pre-1907 documents added to CAS
                   databases
 NEWS 18  DEC 22   IFIPAT/IFIUDB/IFICDB reloaded with new data and search fields
 NEWS 19  DEC 22   ABI-INFORM now available on STN
 NEWS 20  JAN 27   Source of Registration (SR) information in REGISTRY updated
                   and searchable
 NEWS 21  JAN 27   A new search aid, the Company Name Thesaurus, available in
                   CA/CAplus
 NEWS 22  FEB 05   German (DE) application and patent publication number format
                   changes

 NEWS EXPRESS  DECEMBER 28 CURRENT WINDOWS VERSION IS V7.00, CURRENT
               MACINTOSH VERSION IS V6.0b(ENG) AND V6.0Jb(JP),
               AND CURRENT DISCOVER FILE IS DATED 23 SEPTEMBER 2003
 NEWS HOURS    STN Operating Hours Plus Help Desk Availability
 NEWS INTER    General Internet Information
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=> s water channel activity and protein
   5 FILES SEARCHED...
L1          81 WATER CHANNEL ACTIVITY AND PROTEIN

=> s DNA encoding protein and l1
   3 FILES SEARCHED...
L2           0 DNA ENCODING PROTEIN AND L1

=> d l1 ti abs ibib tot

L1   ANSWER 1 OF 81     MEDLINE on STN
TI   Interactions between Plasma Membrane Aquaporins Modulate Their
     Water Channel Activity.
AB   Plant plasma membrane intrinsic proteins (PIPs) cluster in two
     evolutionary subgroups, PIP1 and PIP2, with different aquaporin activities
     when expressed in Xenopus oocytes. Maize ZmPIP1;1 and ZmPIP1;2 do not
     increase the osmotic water permeability coefficient (Pf), whereas
     ZmPIP2;1, ZmPIP2;4, and ZmPIP2;5 do. Here, we show that coexpression of
     the nonfunctional ZmPIP1;2 and the functional ZmPIP2;1, ZmPIP2;4, or
     ZmPIP2;5 resulted in an increase in Pf that was dependent on the amount of
     injected ZmPIP1;2 complementary RNA. Confocal analysis of oocytes
     expressing ZmPIP1;2-green fluorescent protein (GFP) alone or
     ZmPIP1;2-GFP plus ZmPIP2;5 showed that the amount of ZmPIP1;2-GFP present
     in the plasma membrane was significantly greater in coexpressing cells.
     Nickel affinity chromatography purification of ZmPIP2;1 fused to a His tag
     coeluted with ZmPIP1;2-GFP demonstrated physical interaction and
     heteromerization of both isoforms. Interestingly, coexpression of
     ZmPIP1;1 and ZmPIP2;5 did not result in a greater increase in Pf than did
     the expression of ZmPIP2;5 alone, but coexpression of the ZmPIP1;1 and
     ZmPIP1;2 isoforms induced a Pf increase, indicating that PIP1 isoform
     heteromerization is required for both of them to act as functional water
     channels. Mutational analysis demonstrated the important role of the
     C-terminal part of loop E in PIP interaction and water
     channel activity induction. This study has revealed a
     new mechanism of plant aquaporin regulation that might be important in
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plant water relations.
ACCESSION NUMBER: 2004007935 IN-PROCESS
DOCUMENT NUMBER: PubMed ID: 14671024
TITLE: Interactions between Plasma Membrane Aquaporins Modulate Their **Water Channel Activity**.
AUTHOR: Fetter Karolina; Van Wilder Valerie; Moshelion Menachem; Chaumont Francois
CORPORATE SOURCE: Unite de Biochimie Physiologique, Institut des Science de la Vie, Universite Catholique de Louvain, Croix du Sud 2-20, B-1348 Louvain-la-Neuve, Belgium.
SOURCE: Plant cell, (2004 Jan) 16 (1) 215-28.
Journal code: 9208688. ISSN: 1040-4651.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: IN-DATA-REVIEW; IN-PROCESS; NONINDEXED; Priority Journals
ENTRY DATE: Entered STN: 20040106
Last Updated on STN: 20040106

L1 ANSWER 2 OF 81 MEDLINE on STN
TI Plasma membrane aquaporins are involved in winter embolism recovery in walnut tree.
AB In perennial plants, freeze-thaw cycles during the winter months can induce the formation of air bubbles in xylem vessels, leading to changes in their hydraulic conductivity. Refilling of embolized xylem vessels requires an osmotic force that is created by the accumulation of soluble sugars in the vessels. Low water potential leads to water movement from the parenchyma cells into the xylem vessels. The water flux gives rise to a positive pressure essential for the recovery of xylem hydraulic conductivity. We investigated the possible role of plasma membrane aquaporins in winter embolism recovery in walnut (Juglans regia). First, we established that xylem parenchyma starch is converted to sucrose in the winter months. Then, from a xylem-derived cDNA library, we isolated two PIP2 aquaporin genes (JrPIP2,1 and JrPIP2,2) that encode nearly identical proteins. The **water channel activity** of the JrPIP2,1 **protein** was demonstrated by its expression in Xenopus laevis oocytes. The expression of the two PIP2 isoforms was investigated throughout the autumn-winter period. In the winter period, high levels of PIP2 mRNA and corresponding **protein** occurred simultaneously with the rise in sucrose. Furthermore, immunolocalization studies in the winter period show that PIP2 aquaporins were mainly localized in vessel-associated cells, which play a major role in controlling solute flux between parenchyma cells and xylem vessels. Taken together, our data suggest that PIP2 aquaporins could play a role in water transport between xylem parenchyma cells and embolized vessels.
ACCESSION NUMBER: 2003478015 MEDLINE
DOCUMENT NUMBER: PubMed ID: 14526109
TITLE: Plasma membrane aquaporins are involved in winter embolism recovery in walnut tree.
AUTHOR: Sakr Soulaiman; Alves Georges; Morillon Raphael; Maurel Karine; Decourteix Melanie; Guilliot Agnes; Fleurat-Lessard Pierrette; Julien Jean-Louis; Chrispeels Maarten J
CORPORATE SOURCE: Unite Mixte de Recherche 547-Physiologie Integree de d'Arbre Fruitier Institut National de la Recherche Agronomique, Site des Cezeaux, Universite Blaise Pascal, 24 Avenue des Landais, 63177 Aubiere cedex, France.. Soulaiman.Sakr@piaf.univ-bpclermont.fr
SOURCE: Plant physiology, (2003 Oct) 133 (2) 630-41.
Journal code: 0401224. ISSN: 0032-0889.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200401

ENTRY DATE: Entered STN: 20031015
Last Updated on STN: 20040124
Entered Medline: 20040123

L1 ANSWER 3 OF 81 MEDLINE on STN
TI Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.
AB The aquaporin PM28A is one of the major integral proteins in spinach leaf plasma membranes. Phosphorylation/dephosphorylation of Ser274 at the C-terminus and of Ser115 in the first cytoplasmic loop has been shown to regulate the **water channel activity** of PM28A when expressed in Xenopus oocytes. To understand the mechanisms of the phosphorylation-mediated gating of the channel the structure of PM28A is required. In a first step we have used the methylotrophic yeast Pichia pastoris for expression of the pm28a gene. The expressed **protein** has a molecular mass of 32462 Da as determined by matrix-assisted laser desorption ionization-mass spectrometry, forms tetramers as revealed by electron microscopy and is functionally active when reconstituted in proteoliposomes. PM28A was efficiently solubilized from urea- and alkali-stripped Pichia membranes by octyl-beta-D-thioglucopyranoside resulting in a final yield of 25 mg of purified **protein** per liter of cell culture.
ACCESSION NUMBER: 2003094806 MEDLINE
DOCUMENT NUMBER: 22494699 PubMed ID: 12606033
TITLE: Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.
AUTHOR: Karlsson Maria; Fotiadis Dimitrios; Sjovall Sara; Johansson Ingela; Hedfalk Kristina; Engel Andreas; Kjellbom Per
CORPORATE SOURCE: Department of Plant Biochemistry, Lund University, Box 124, Sweden.. maria.karlsson@plantbio.lu.se
SOURCE: FEBS LETTERS, (2003 Feb 27) 537 (1-3) 68-72.
Journal code: 0155157. ISSN: 0014-5793.
PUB. COUNTRY: Netherlands
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200304
ENTRY DATE: Entered STN: 20030228
Last Updated on STN: 20030419
Entered Medline: 20030418

L1 ANSWER 4 OF 81 MEDLINE on STN
TI Characterization of two tomato aquaporins and expression during the incompatible interaction of tomato with the plant parasite Cuscuta reflexa.
AB A subtractive suppression hybridization technique was used to identify genes that were induced during early phases of the interaction between Cuscuta reflexa, a phanerogamic plant parasite and the incompatible host tomato (Lycopersicon esculentum Mill.). One of the identified genes encodes a new aquaporin (LeAqp2) from tomato. Its function was concluded from the swelling kinetics of LeAqp2-expressing Xenopus laevis oocytes under hypo-osmotic conditions. It was shown that, 6 h after attachment of the plant parasite, the corresponding mRNA accumulated in cells at and adjacent to the attachment site of Cuscuta, while artificial wounding did not modify steady-state LeAqp2- RNA levels. Expression of a close homologue named TRAMP (tomato-ripening-associated **protein**) was not affected by the plant-plant interaction. Levels of indole-3-acetic acid (IAA) in tomato tissue after infection by Cuscuta have been found to increase at a similar stage of infection. In contrast to the different behavior with respect to infection, IAA induced both LeAqp2 and TRAMP expression. The observed pattern of LeAqp2 expression during the interaction at a stage where cell elongation occurs together with the **water-channel activity** in the heterologous expression system suggest a function for LeAqp2 during the tomato-Cuscuta

interaction.
ACCESSION NUMBER: 2001508195 MEDLINE
DOCUMENT NUMBER: 21440500 PubMed ID: 11556787
TITLE: Characterization of two tomato aquaporins and expression during the incompatible interaction of tomato with the plant parasite Cuscuta reflexa.
AUTHOR: Werner M; Uehlein N; Proksch P; Kaldenhoff R
CORPORATE SOURCE: Heinrich-Heine-Universitat Dusseldorf, Institut fur Pharmazeutische Biologie, Germany.
SOURCE: PLANTA, (2001 Aug) 213 (4) 550-5.
Journal code: 1250576. ISSN: 0032-0935.
PUB. COUNTRY: Germany: Germany, Federal Republic of
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
OTHER SOURCE: GENBANK-AF218774
ENTRY MONTH: 200204
ENTRY DATE: Entered STN: 20010917
Last Updated on STN: 20020416
Entered Medline: 20020415

L1 ANSWER 5 OF 81 MEDLINE on STN
TI Highly selective **water channel activity** measured by voltage clamp: analysis of planar lipid bilayers reconstituted with purified AqpZ.
AB Aquaporins are membrane channels selectively permeated by water or water plus glycerol. Conflicting reports have described ion conductance associated with some water channels, raising the question of whether ion conductance is a general property of the aquaporin family. To clarify this question, a defined system was developed to simultaneously measure water permeability and ion conductance. The Escherichia coli water channel aquaporin-Z (AqpZ) was studied, because it is a highly stable tetramer. Planar lipid bilayers were formed from unilamellar vesicles containing purified AqpZ. The hydraulic conductivity of bilayers made from the total extract of E. coli lipids increased 3-fold if reconstituted with AqpZ, but electric conductance was unchanged. No channel activity was detected under voltage-clamp conditions, indicating that less than one in 10(9) transport events is electrogenic. Microelectrode measurements were simultaneously undertaken adjacent to the membrane. Changes in sodium concentration profiles accompanying transmembrane water flow permitted calculation of the activation energies: 14 kcal/mol for **protein**-free lipid bilayers and 4 kcal/mol for lipid bilayers containing AqpZ. Neither the water permeability nor the electric conductivity exhibited voltage dependence. This sensitive system demonstrated that AqpZ is permeated by water but not charged ions and should permit direct analyses of putative electrogenic properties of other aquaporins.
ACCESSION NUMBER: 2001459189 MEDLINE
DOCUMENT NUMBER: 21396543 PubMed ID: 11493683
TITLE: Highly selective **water channel activity** measured by voltage clamp: analysis of planar lipid bilayers reconstituted with purified AqpZ.
AUTHOR: Pohl P; Saparov S M; Borgnia M J; Agre P
CORPORATE SOURCE: Forschungsinstitut fur Molekulare Pharmakologie, Nachwuchsgruppe Biophysik, Robert-Roessle-Strasse 10, 13125 Berlin, Germany.. pohl@fmp-berlin.de
CONTRACT NUMBER: EY11239 (NEI)
HL33991 (NHLBI)
HL48268 (NHLBI)
SOURCE: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, (2001 Aug 14) 98 (17) 9624-9.
Journal code: 7505876. ISSN: 0027-8424.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)

LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200109
ENTRY DATE: Entered STN: 20010816
Last Updated on STN: 20030328
Entered Medline: 20010920

L1 ANSWER 6 OF 81 MEDLINE on STN
TI Existence of a tightly regulated water channel in Saccharomyces cerevisiae.
AB The Saccharomyces cerevisiae strain Sigma1278b possesses two putative aquaporins, Aqy1-1p and Aqy2-1p. Previous work demonstrated that Aqy1-1p functions as a water channel in Xenopus oocyte. However, no function could be attributed to Aqy2-1p in this system. Specific antibodies were used to follow the expression of Aqy1-1p and Aqy2-1p in the yeast. Aqy1-1p was never detected whatever the growth phase and culture conditions tested. In contrast, Aqy2-1p was detected only during the exponential growth phase in rich medium containing glucose. Aqy2-1p expression was repressed by hyper-osmotic culture conditions. Both immunocytochemistry and biochemical subcellular fractionation demonstrated that Aqy2-1p is located on the endoplasmic reticulum (ER) as well as on the plasma membrane. In microsomal vesicles enriched in ER, a **water channel activity** due to Aqy2-1p was detected by stopped-flow analysis. Our results show that the expression of aquaporins is tightly controlled. The physiological relevance of aquaporin-mediated water transport in yeast is discussed.
ACCESSION NUMBER: 2001179930 MEDLINE
DOCUMENT NUMBER: 21099298 PubMed ID: 11168368
TITLE: Existence of a tightly regulated water channel in Saccharomyces cerevisiae.
AUTHOR: Meyrial V; Laize V; Gobin R; Ripoche P; Hohmann S; Tacnet F
CORPORATE SOURCE: Departement de Biologie Cellulaire et Moleculaire, SBCe, CEA/Saclay, Gif sur Yvette cedex F-91191, France.
SOURCE: EUROPEAN JOURNAL OF BIOCHEMISTRY, (2001 Jan) 268 (2) 334-43.
Journal code: 0107600. ISSN: 0014-2956.
PUB. COUNTRY: Germany: Germany, Federal Republic of
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200103
ENTRY DATE: Entered STN: 20010404
Last Updated on STN: 20010404
Entered Medline: 20010329

L1 ANSWER 7 OF 81 MEDLINE on STN
TI Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.
AB Opacities in the crystalline lens of eye appear with high frequency in the general population. Dominantly inherited cataracts with differing clinical features were found in two families carrying different point mutations in the gene encoding lens water channel **protein** AQP0 (major intrinsic **protein**, MIP). Families with E134G have a uni-lamellar cataract which is stable after birth, whereas families with T138R have multi-focal opacities which increase throughout life. To establish pathophysiological relevance of cataract formation, the Xenopus laevis oocyte expression system was employed to evaluate functional defects in the mutant proteins, E134G and T138R. Both substitutions cause loss of membrane **water channel activity** due to impaired trafficking of the mutant proteins to the oocyte plasma membrane. Although missense mutations in AQP1 and AQP2 proteins are known to result in recessive traits in vivo and in vitro, when E134G or T138R are co-expressed with wild-type AQP0 **protein**, the mutant proteins exhibit dominant negative behaviour. To our knowledge, these

studies represent the first in vitro demonstration of functionally defective AQP0 **protein** from humans with congenital cataracts. Moreover, these observations predict that less severe defects in the AQP0 **protein** may contribute to lens opacity in patients with common, less fulminant forms of cataracts.

ACCESSION NUMBER: 2001103488 MEDLINE
DOCUMENT NUMBER: 20458899 PubMed ID: 11001937
TITLE: Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.
AUTHOR: Francis P; Chung J J; Yasui M; Berry V; Moore A; Wyatt M K; Wistow G; Bhattacharya S S; Agre P
CORPORATE SOURCE: Department of Molecular Genetics, Institute of Ophthalmology, University College and Moorfields Eye Hospital, 11-43 Bath Street, London EC1V 9EL, UK.
CONTRACT NUMBER: EY11239 (NEI)
HL33991 (NHLBI)
HL48268 (NHLBI)
SOURCE: HUMAN MOLECULAR GENETICS, (2000 Sep 22) 9 (15) 2329-34. Journal code: 9208958. ISSN: 0964-6906.
PUB. COUNTRY: ENGLAND: United Kingdom
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200102
ENTRY DATE: Entered STN: 20010322
Last Updated on STN: 20010322
Entered Medline: 20010208

L1 ANSWER 8 OF 81 MEDLINE on STN
TI Aquaporin PIP genes are not expressed in the stigma papillae in Brassica oleracea.
AB The pollen grains of angiosperms are usually desiccated at maturity. Following pollination, pollen hydrates on the stigma surface before germination takes place. Rehydration is an essential step for the success of pollination and depends on the movement of water from the stigmatic cells. This water flow has been shown to be biologically regulated, and components of both pollen and stigma surfaces have been demonstrated to play a role in the control of pollen hydration. Regulation of water transport between animal or plant cells involves membrane proteins, designated aquaporins, which possess **water-channel activity**. Such molecules may be candidates for controlling pollen hydration, and consequently we investigated whether aquaporins are present in the pollen and stigma cells in Brassica oleracea. Here, we report the identification of two new aquaporin genes, Bo-PIP1b1 and Bo-PIP1b2, which are highly homologous to PIP1b from Arabidopsis thaliana. Both Bo-PIP1b1 and Bo-PIP1b2 proteins are active water channels when expressed in Xenopus oocytes. Expression of Bo-PIP1b1 and Bo-PIP1b2 was observed in reproductive organs as well as in vegetative tissues. Interestingly, the use of a Bo-PIP1b2 cDNA probe revealed that PIP1-like transcripts were not present in the pollen grains or in the stigma papillae, but were present in the stigma cell layers underlying the papillar cells. This observation suggests that water flow between the pollen and stigma papillae may be dependent on aquaporins expressed in cells that are not directly in contact with the pollen grain.

ACCESSION NUMBER: 2001081493 MEDLINE
DOCUMENT NUMBER: PubMed ID: 11069697
TITLE: Aquaporin PIP genes are not expressed in the stigma papillae in Brassica oleracea.
AUTHOR: Marin-Olivier M; Chevalier T; Fobis-Loisy I; Dumas C; Gaude T
CORPORATE SOURCE: Laboratoire de Reproduction et Developpement des Plantes, UMR 5667 CNRS-INRA-ENS-UCBL, 46 Allee d'Italie, 69364 Lyon Cedex 07, France.
SOURCE: Plant journal : for cell and molecular biology, (2000 Oct)

24 (2) 231-40.
Journal code: 9207397. ISSN: 0960-7412.
PUB. COUNTRY: ENGLAND: United Kingdom
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
OTHER SOURCE: GENBANK-AF299050; GENBANK-AF299051
ENTRY MONTH: 200101
ENTRY DATE: Entered STN: 20010322
Last Updated on STN: 20010322
Entered Medline: 20010105

L1 ANSWER 9 OF 81 MEDLINE on STN
TI Identification of sequence determinants that direct different intracellular folding pathways for aquaporin-1 and aquaporin-4.
AB Homologous aquaporin water channels utilize different folding pathways to acquire their transmembrane (TM) topology in the endoplasmic reticulum (ER). AQP4 acquires each of its six TM segments via cotranslational translocation events, whereas AQP1 is initially synthesized with four TM segments and subsequently converted into a six membrane-spanning topology. To identify sequence determinants responsible for these pathways, peptide segments from AQP1 and AQP4 were systematically exchanged. Chimeric proteins were then truncated, fused to a C-terminal translocation reporter, and topology was analyzed by protease accessibility. In each chimeric context, TM1 initiated ER targeting and translocation. However, AQP4-TM2 cotranslationally terminated translocation, while AQP1-TM2 failed to terminate translocation and passed into the ER lumen. This difference in stop transfer activity was due to two residues that altered both the length and hydrophobicity of TM2 (Asn(49) and Lys(51) in AQP1 versus Met(48) and Leu(50) in AQP4). A second peptide region was identified within the TM3-4 peptide loop that enabled AQP4-TM3 but not AQP1-TM3 to reinitiate translocation and cotranslationally span the membrane. Based on these findings, it was possible to convert AQP1 into a cotranslational biogenesis mode similar to that of AQP4 by substituting just two peptide regions at the N terminus of TM2 and the C terminus of TM3. Interestingly, each of these substitutions disrupted **water channel activity**. These data thus establish the structural basis for different AQP folding pathways and provide evidence that variations in cotranslational folding enable polytopic proteins to acquire and/or maintain primary sequence determinants necessary for function.
ACCESSION NUMBER: 2001048355 MEDLINE
DOCUMENT NUMBER: 20507854 PubMed ID: 10944517
TITLE: Identification of sequence determinants that direct different intracellular folding pathways for aquaporin-1 and aquaporin-4.
AUTHOR: Foster W; Helm A; Turnbull I; Gulati H; Yang B; Verkman A S; Skach W R
CORPORATE SOURCE: Division of Molecular Medicine, Oregon Health Sciences University, Portland, Oregon 97201, USA.
CONTRACT NUMBER: DK51818 (NIDDK)
GM53457 (NIGMS)
SOURCE: JOURNAL OF BIOLOGICAL CHEMISTRY, (2000 Nov 3) 275 (44) 34157-65.
Journal code: 2985121R. ISSN: 0021-9258.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200012
ENTRY DATE: Entered STN: 20010322
Last Updated on STN: 20010322
Entered Medline: 20001214

L1 ANSWER 10 OF 81 MEDLINE on STN
TI **Protein** kinase A-dependent phosphorylation of aquaporin-1.
AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. Previous results from our laboratory demonstrated that **water channel activity** of AQP1 was significantly increased by **protein** kinase A (PKA) activators such as cyclic-AMP (cAMP) and forskolin. The purpose of this study is to determine whether PKA-dependent **protein** phosphorylation is involved in the regulation of **water channel activity** of AQP1. Results presented here suggest that catalytic subunit of **protein** kinase A significantly increased the amount of phosphorylated AQP1 **protein**. In addition, these results indicated that cAMP-responsive redistribution of AQP1 may be regulated by phosphorylation of AQP1. Moreover, they provide new insights on the molecular mechanisms for regulating water balance in several tissues involving rapid water transport such as ciliary epithelium. In addition, they suggest important potential roles for AQP1 in several clinical disorders involving rapid water transport such as glaucoma.

ACCESSION NUMBER: 2000334271 MEDLINE
DOCUMENT NUMBER: 20334271 PubMed ID: 10873606
TITLE: **Protein** kinase A-dependent phosphorylation of aquaporin-1.
AUTHOR: Han Z; Patil R V
CORPORATE SOURCE: Department of Ophthalmology and Visual Sciences, Washington University School of Medicine, St. Louis, Missouri 63110, USA.
CONTRACT NUMBER: EY10423 (NEI)
SOURCE: BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS, (2000 Jun 24) 273 (1) 328-32.
Journal code: 0372516. ISSN: 0006-291X.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200007
ENTRY DATE: Entered STN: 20000810
Last Updated on STN: 20000810
Entered Medline: 20000727

L1 ANSWER 11 OF 81 MEDLINE on STN
TI Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
AB The water channel **protein** alpha-TIP is a member of the major intrinsic **protein** (MIP) membrane channel family. This aquaporin is found abundantly in vacuolar membranes of cotyledons (seed storage organs) and is synthesized during seed maturation. The **water channel activity** of alpha-TIP can be regulated by phosphorylation, and the **protein** may function in seed desiccation, cytoplasmic osmoregulation, and/or seed rehydration. Alpha-TIP was purified from seed meal of the common bean (Phaseolus vulgaris) by membrane fractionation, solubilization in diheptanoylphosphocholine and anion-exchange chromatography. Upon detergent removal and reconstitution into lipid bilayers, alpha-TIP crystallized as helical tubes. Electron cryo-crystallography of flattened tubes demonstrated that the crystals exhibit plane group p2 symmetry and c222 pseudosymmetry. Since the 2D crystals with p2 symmetry are derived from helical tubes, we infer that the unit of crystallization on the helical lattice is a dimer of tetramers. A projection density map at a resolution of 7.7 A revealed that alpha-TIP assembles as a 60 A x 60 A square tetramer. Each subunit is formed by a heart-shaped ring comprised

of density peaks which we interpret as alpha-helices. The similarity of this structure to mammalian plasma membrane MIP-family proteins suggests that the molecular design of functionally analogous and genetically homologous aquaporins is maintained between the plant and animal kingdoms. Copyright 1999 Academic Press.

ACCESSION NUMBER: 2000069952 MEDLINE
DOCUMENT NUMBER: PubMed ID: 10600389
TITLE: Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
COMMENT: Erratum in: J Mol Biol 2000 Mar 3;296(4):1163
AUTHOR: Daniels M J; Chrispeels M J; Yeager M
CORPORATE SOURCE: Department of Cell Biology, The Scripps Research Institute, 10550 North Torrey Pines Road, La Jolla, CA 92037, USA.
SOURCE: Journal of molecular biology, (1999 Dec 17) 294 (5) 1337-49.
Journal code: 2985088R. ISSN: 0022-2836.
PUB. COUNTRY: ENGLAND: United Kingdom
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200001
ENTRY DATE: Entered STN: 20000124
Last Updated on STN: 20000622
Entered Medline: 20000111

L1 ANSWER 12 OF 81 MEDLINE on STN
TI Transmembrane helix 5 is critical for the high water permeability of aquaporin.
AB Aquaporin-2 (AQP2), a vasopressin-regulated water channel, plays a major role in urinary concentration. AQP2 and the major intrinsic **protein** (MIP) of lens fiber are highly homologous (58% amino acid identity) and share a topology of six transmembrane helices connected by five loops (loops A-E). Despite the similarities of these proteins, however, the **water channel activity** of AQP2 is much higher than that of MIP. To determine the site responsible for this gain of activity in AQP2, several parts of MIP were replaced with the corresponding parts of AQP2. When expressed in Xenopus oocytes, the osmotic water permeability (P(f)) of MIP and AQP2 was 48 and 245 x 10(-)(4) cm/s, respectively. Substitutions in loops B-D failed to increase P(f), whereas substitution of loop E significantly increased P(f) 1.5-fold. A similar increase in P(f) was observed with the substitution of the front half of loop E. P(f) measurements taken in a yeast vesicle expression system also confirmed that loop E had a complementary effect, whereas loops B-D did not. However, P(f) values of the loop E chimeras were only approximately 30% of that of AQP2. Simultaneous exchanges of loop E and a distal half of transmembrane helix 5 just proximal to loop E increased P(f) to the level of that of AQP2. Replacement of helix 5 alone stimulated P(f) 2.7-fold. Conversely, P(f) was decreased by 73% when helix 5 of AQP2 was replaced with that of MIP. Moreover, P(f) was stimulated 2.6- and 3.3-fold after helix 5 of AQP1 and AQP4 was spliced into MIP, respectively. Our findings suggested that the distal half of helix 5 is necessary for maximum **water channel activity** in AQP. We speculate that this portion contributes to the formation of the aqueous pore and the determination of the flux rate.

ACCESSION NUMBER: 2000056056 MEDLINE
DOCUMENT NUMBER: 20056056 PubMed ID: 10587459
TITLE: Transmembrane helix 5 is critical for the high water permeability of aquaporin.
AUTHOR: Kuwahara M; Shinbo I; Sato K; Terada Y; Marumo F; Sasaki S
CORPORATE SOURCE: Second Department of Internal Medicine, School of Medicine, Tokyo Medical and Dental University, Japan.
SOURCE: BIOCHEMISTRY, (1999 Dec 7) 38 (49) 16340-6.
Journal code: 0370623. ISSN: 0006-2960.
PUB. COUNTRY: United States

DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200001
ENTRY DATE: Entered STN: 20000124
Last Updated on STN: 20000124
Entered Medline: 20000110

L1 ANSWER 13 OF 81 MEDLINE on STN
TI Molecular cloning, **water channel activity** and tissue specific expression of two isoforms of radish vacuolar aquaporin.
AB A major membrane intrinsic **protein** (VM23) in vacuoles of radish (Raphanus) tap root was investigated. The cDNAs for two isoforms of VM23, gamma- and delta-VM23, encode polypeptides of 253 and 248 amino acids, respectively. gamma- and delta-VM23 correspond to the gamma- and delta-TIP (tonoplast intrinsic **protein**) of Arabidopsis. The deduced amino acid sequences of the two VM23 isoforms were 60% identical. The amino-terminal sequence of gamma-VM23 showed agreement with the direct sequence of the purified VM23, suggesting that gamma-VM23 is the most abundant molecule among the VM23 isoforms. When mRNAs of gamma- and delta-VM23 were injected into Xenopus oocytes, the osmotic water permeability of oocytes increased 6-fold (60 to 200 microns s-1) of the control oocytes. The transcripts of both isoforms were detected in a high level in growing hypocotyls and young leaves, but delta-VM23 was not detected in seedling roots. Light illumination enhanced the transcription of two genes of VM23 in cotyledons and roots but suppressed their expression in hypocotyls the growth of which was inhibited by light. These findings suggest that the expression of VM23 is tightly related to cell elongation.
ACCESSION NUMBER: 1999033463 MEDLINE
DOCUMENT NUMBER: 99033463 PubMed ID: 9816675
TITLE: Molecular cloning, **water channel activity** and tissue specific expression of two isoforms of radish vacuolar aquaporin.
AUTHOR: Higuchi T; Suga S; Tsuchiya T; Hisada H; Morishima S; Okada Y; Maeshima M
CORPORATE SOURCE: Laboratory of Biochemistry, Graduate School of Bioagricultural Sciences, Nagoya University, Japan.
SOURCE: PLANT AND CELL PHYSIOLOGY, (1998 Sep) 39 (9) 905-13.
Journal code: 9430925. ISSN: 0032-0781.
PUB. COUNTRY: Japan
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
OTHER SOURCE: GENBANK-AB010416; GENBANK-D84669
ENTRY MONTH: 199812
ENTRY DATE: Entered STN: 19990115
Last Updated on STN: 20000303
Entered Medline: 19981202

L1 ANSWER 14 OF 81 MEDLINE on STN
TI Progress on the structure and function of aquaporin 1.
AB Life exists in water as universal solvent, and cells need to deal with its influx and efflux. Nature has accomplished the almost impossible, creating membrane channels with both a high flux and a high specificity for water. The first water channel was discovered in red blood cell membranes. Today known as aquaporin-1, this channel was found to be closely related to the major integral **protein** (MIP)1 of the eye lens. Cloning and sequencing of numerous related proteins of the MIP family revealed the widespread occurrence of such channels, suggesting an essential physiological function. Their structures hold the clues to the remarkable **water channel activity**, as well as to the arrangement of transmembrane segments in general. Recent

medium-resolution three-dimensional electron microscopic studies determined a tetrameric complex with six tilted transmembrane helices per monomer. The helices within each monomer surround a central density formed by two interhelical loops implicated by mutagenesis in the water channel function. A combination of sequence analysis and assignment of the observed densities to predicted helices provides a basis for speculation on the nature of the water course through the **protein** . In particular, four highly conserved polar residues, E142-N192-N76-E17, are proposed to form a chain of key groups involved in the pathway of water flow through the channel.

ACCESSION NUMBER: 1998277672 MEDLINE
DOCUMENT NUMBER: 98277672 PubMed ID: 9615438
TITLE: Progress on the structure and function of aquaporin 1.
AUTHOR: Heymann J B; Agre P; Engel A
CORPORATE SOURCE: M. E. Muller-Institute for Microscopic Structural Biology, Biozentrum, University of Basel, Switzerland.
SOURCE: JOURNAL OF STRUCTURAL BIOLOGY, (1998) 121 (2) 191-206. Ref: 88
Journal code: 9011206. ISSN: 1047-8477.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
General Review; (REVIEW)
(REVIEW, TUTORIAL)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199807
ENTRY DATE: Entered STN: 19980723
Last Updated on STN: 19980723
Entered Medline: 19980713

L1 ANSWER 15 OF 81 MEDLINE on STN
TI Water transport activity of the plasma membrane aquaporin PM28A is regulated by phosphorylation.
AB PM28A is a major intrinsic **protein** of the spinach leaf plasma membrane and the major phosphoprotein. Phosphorylation of PM28A is dependent in vivo on the apoplastic water potential and in vitro on submicromolar concentrations of Ca2+. Here, we demonstrate that PM28A is an aquaporin and that its **water channel activity** is regulated by phosphorylation. Wild-type and mutant forms of PM28A, in which putative phosphorylation sites had been knocked out, were expressed in Xenopus oocytes, and the resulting increase in osmotic water permeability was measured in the presence or absence of an inhibitor of **protein** kinases (K252a) or of an inhibitor of **protein** phosphatases (okadaic acid). The results indicate that the **water channel activity** of PM28A is regulated by phosphorylation of two serine residues, Ser-115 in the first cytoplasmic loop and Ser-274 in the C-terminal region. Labeling of spinach leaves with 32P-orthophosphate and subsequent sequencing of PM28A-derived peptides demonstrated that Ser-274 is phosphorylated in vivo, whereas phosphorylation of Ser-115, a residue conserved among all plant plasma membrane aquaporins, could not be demonstrated. This identifies Ser-274 of PM28A as the amino acid residue being phosphorylated in vivo in response to increasing apoplastic water potential and dephosphorylated in response to decreasing water potential. Taken together, our results suggest an active role for PM28A in maintaining cellular water balance.

ACCESSION NUMBER: 1998169350 MEDLINE
DOCUMENT NUMBER: 98169350 PubMed ID: 9501117
TITLE: Water transport activity of the plasma membrane aquaporin PM28A is regulated by phosphorylation.
AUTHOR: Johansson I; Karlsson M; Shukla V K; Chrispeels M J; Larsson C; Kjellbom P
CORPORATE SOURCE: Department of Plant Biochemistry, Lund University, P.O. Box 117, SE-221 00 Lund, Sweden.

SOURCE: PLANT CELL, (1998 Mar) 10 (3) 451-9.
Journal code: 9208688. ISSN: 1040-4651.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199804
ENTRY DATE: Entered STN: 19980422
Last Updated on STN: 19980422
Entered Medline: 19980416

L1 ANSWER 16 OF 81 MEDLINE on STN
TI Regulation of aquaporin-4 water channels by phorbol ester-dependent **protein** phosphorylation.
AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. However, because humans with defective AQP1 are phenotypically normal and because the ocular application of phorbol esters reduce intraocular pressure, we postulated that the **water channel activity** of AQP4 may be regulated by these agents. We now report that **protein** kinase C activators, phorbol 12,13-dibutyrate, and phorbol 12-myristate 13-acetate strongly stimulate the phosphorylation of AQP4 and inhibit its activity in a dose-dependent manner. Phorbol 12,13-dibutyrate (10 microM) and phorbol 12-myristate 13-acetate (10 nM) reduced the rate of AQP4-expressing oocyte swelling by 87 and 92%, respectively. Further, phorbol 12,13-dibutyrate significantly increased the amount of phosphorylated AQP4. These results demonstrate that **protein** kinase C can regulate the activity of AQP4 through a mechanism involving **protein** phosphorylation. Moreover, they suggest important potential roles for AQP4 in several clinical disorders involving rapid water transport such as glaucoma, brain edema, and swelling of premature infant lungs.
ACCESSION NUMBER: 1998165767 MEDLINE
DOCUMENT NUMBER: 98165767 PubMed ID: 9497312
TITLE: Regulation of aquaporin-4 water channels by phorbol ester-dependent **protein** phosphorylation.
AUTHOR: Han Z; Wax M B; Patil R V
CORPORATE SOURCE: Department of Ophthalmology and Visual Sciences, Washington University School of Medicine, St. Louis, Missouri 63110, USA.
CONTRACT NUMBER: EY02687 (NEI)
EY06810 (NEI)
EY10423 (NEI)
SOURCE: JOURNAL OF BIOLOGICAL CHEMISTRY, (1998 Mar 13) 273 (11) 6001-4.
Journal code: 2985121R. ISSN: 0021-9258.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199804
ENTRY DATE: Entered STN: 19980416
Last Updated on STN: 19980416
Entered Medline: 19980407

L1 ANSWER 17 OF 81 MEDLINE on STN
TI Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AB Aquaporin 1 (AQP1), a six-transmembrane domain **protein** that functions as a water channel, is present in many fluid secreting and absorbing tissues such as kidney, brain, heart, and eye. It is believed that among the five known mammalian aquaporins, kidney aquaporin (AQP2) is

the only water channel that is regulated by arginine vasopressin (AVP). The present data suggest that AQP1 may also be regulated by AVP. The application of AVP to Xenopus oocytes injected with AQP1 cRNA increased the membrane permeability to water. In addition, our data reveal that atrial natriuretic peptide (ANP), a peptide hormone that plays an important role in the regulation of body fluid homeostasis, blocks the AQP1-mediated increase in water permeability. Incubation with 8-bromo-cAMP or direct 8-bromo-cAMP injection into oocytes expressing AQP1 cRNA significantly increased membrane permeability to water, suggesting that stimulation of AQP1 activity by AVP may involve a cAMP-dependent mechanism. Regulation of water permeability by AVP and ANP has potential relevance to active water transport in a variety of tissues that express AQP1 including kidney, brain, and eye.

ACCESSION NUMBER: 97445992 MEDLINE
DOCUMENT NUMBER: 97445992 PubMed ID: 9299519
TITLE: Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AUTHOR: Patil R V; Han Z; Wax M B
CORPORATE SOURCE: Department of Ophthalmology and Visual Sciences, Washington University School of Medicine, St. Louis, Missouri 63110, USA.. patil@am.seer.wustl.edu
CONTRACT NUMBER: EY02687 (NEI)
SOURCE: BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS, (1997 Sep 18) 238 (2) 392-6.
Journal code: 0372516. ISSN: 0006-291X.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199710
ENTRY DATE: Entered STN: 19971024
Last Updated on STN: 19971024
Entered Medline: 19971016

L1 ANSWER 18 OF 81 MEDLINE on STN
TI Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AB Aquaporin-3 (AQP3) is unique in its structure (lowest homology with other aquaporins) and in its function (significantly conductive to both small nonelectrolytes and water). However, there is a controversy among researchers on its water transport and induction by dehydration. We examined its localization and the effect of dehydration on its expression in the kidney, as well as its **water channel activity** when expressed in Xenopus oocytes. In vitro translation using reticulocyte lysate revealed that the size of rat AQP3 was 26 kDa, and the band shifted to around 31 kDa with microsomal fraction, which was sensitive to the digestion with N-glycosidase F. In Western blot analysis of rat kidney medulla, AQP3 appeared as a sharp band at 27 kDa and a broad band at 34-40 kDa. In immunohistochemistry, AQP3 was localized to principal cells and absent in intercalated cells in outer medulla. In inner medulla, AQP3 was restricted to inner medullary collecting duct (IMCD) cells. AQP3 was confined to the basolateral membrane of these cells. Although dehydration of rats for 2 days did not change the distribution pattern of AQP3 in IMCD cells, the dehydration increased AQP3 mRNA by twofold with slight increase of its **protein** level in kidney medulla. Finally, we confirmed its **water channel activity** when expressed in Xenopus oocytes. The human AQP3 stimulated osmotic water permeability by eightfold, which was inhibited by 0.3 mM mercury chloride by 34% and reversed by beta-mercaptoethanol. Our results indicate that AQP3 is a glycosylated **protein** and a mercury-sensitive water channel localized at the basolateral membrane of principal cells and IMCD cells, and its expression is induced by

dehydration at both **protein** and mRNA level.

ACCESSION NUMBER: 97222281 MEDLINE
DOCUMENT NUMBER: 97222281 PubMed ID: 9124401
TITLE: Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AUTHOR: Ishibashi K; Sasaki S; Fushimi K; Yamamoto T; Kuwahara M; Marumo F
CORPORATE SOURCE: Second Department of Internal Medicine, Tokyo Medical and Dental University, Japan.
SOURCE: AMERICAN JOURNAL OF PHYSIOLOGY, (1997 Feb) 272 (2 Pt 2) F235-41.
Journal code: 0370511. ISSN: 0002-9513.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199704
ENTRY DATE: Entered STN: 19970506
Last Updated on STN: 19970506
Entered Medline: 19970422

L1 ANSWER 19 OF 81 MEDLINE on STN
TI Characterization of a new vacuolar membrane aquaporin sensitive to mercury at a unique site.
AB The membranes of plant and animal cells contain aquaporins, proteins that facilitate the transport of water. In plants, aquaporins are found in the vacuolar membrane (tonoplast) and the plasma membrane. Many aquaporins are mercury sensitive, and in AQP1, a mercury-sensitive cysteine residue (Cys-189) is present adjacent to a conserved Asn-Pro-Ala motif. Here, we report the molecular analysis of a new Arabidopsis aquaporin, delta-TIP (for tonoplast intrinsic **protein**), and show that it is located in the tonoplast. The **water channel activity** of delta-TIP is sensitive to mercury. However, the mercury-sensitive cysteine residue found in mammalian aquaporins is not present in delta-TIP, or in gamma-TIP, a previously characterized mercury-sensitive tonoplast aquaporin. Site-directed mutagenesis was used to identify the mercury-sensitive site in these two aquaporins as Cys-116 and Cys-118 for delta-TIP and gamma-TIP, respectively. These mutations are at a conserved position in a presumed membrane-spanning domain not previously known to have a role in aquaporin mercury sensitivity. Comparing the tissue expression patterns of delta-TIP with gamma-TIP and alpha-TIP showed that the TIPs are differentially expressed.

ACCESSION NUMBER: 96206812 MEDLINE
DOCUMENT NUMBER: PubMed ID: 8624437
TITLE: Characterization of a new vacuolar membrane aquaporin sensitive to mercury at a unique site.
AUTHOR: Daniels M J; Chaumont F; Mirkov T E; Chrispeels M J
CORPORATE SOURCE: Department of Biology, University of California at San Diego, La Jolla 92093-0116, USA.
SOURCE: Plant cell, (1996 Apr) 8 (4) 587-99.
Journal code: 9208688. ISSN: 1040-4651.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
OTHER SOURCE: GENBANK-U39485; GENBANK-U39486
ENTRY MONTH: 199606
ENTRY DATE: Entered STN: 19960708
Last Updated on STN: 19980206
Entered Medline: 19960624

L1 ANSWER 20 OF 81 MEDLINE on STN
TI Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin alpha-TIP.

AB The vacuolar membrane **protein** alpha-TIP is a seed-specific **protein** of the Major Intrinsic **Protein** family. Expression of alpha-TIP in Xenopus oocytes conferred a 4- to 8-fold increase in the osmotic water permeability (Pf) of the oocyte plasma membrane, showing that alpha-TIP forms water channels and is thus a new aquaporin. alpha-TIP has three putative phosphorylation sites on the cytoplasmic side of the membrane (Ser7, Ser23 and Ser99), one of which (Ser7) has been shown to be phosphorylated. We present several lines of evidence that the activity of this aquaporin is regulated by phosphorylation. First, mutation of the putative phosphorylation sites in alpha-TIP (Ser7Ala, Ser23Ala and Ser99Ala) reduced the apparent water transport activity of alpha-TIP in oocytes, suggesting that phosphorylation of alpha-TIP occurs in the oocytes and participates in the control of **water channel activity**. Second, exposure of oocytes to the cAMP agonists 8-bromoadenosine 3',5'-cyclic monophosphate, forskolin and 3-isobutyl-1-methylxanthine, which stimulate endogenous **protein** kinase A (PKA), increased the water transport activity of alpha-TIP by 80-100% after 60 min. That the **protein** can be phosphorylated by PKA was demonstrated by phosphorylating alpha-TIP in isolated oocyte membranes with the bovine PKA catalytic subunit. Third, the integrity of the three sites at positions 7, 23 and 99 was necessary for the cAMP-dependent increase in the Pf of oocytes expressing alpha-TIP, as well as for in vitro phosphorylation of alpha-TIP. These findings demonstrate that the alpha-TIP water channel can be modulated via phosphorylation of Ser7, Ser23 and Ser99.(ABSTRACT TRUNCATED AT 250 WORDS)

ACCESSION NUMBER: 95347329 MEDLINE
DOCUMENT NUMBER: PubMed ID: 7542585
TITLE: Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin alpha-TIP.
AUTHOR: Maurel C; Kado R T; Guern J; Chrispeels M J
CORPORATE SOURCE: Institut des Sciences Vegetales, CNRS, Gif-sur-Yvette, France.
SOURCE: EMBO journal, (1995 Jul 3) 14 (13) 3028-35.
Journal code: 8208664. ISSN: 0261-4189.
PUB. COUNTRY: ENGLAND: United Kingdom
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199508
ENTRY DATE: Entered STN: 19950911
Last Updated on STN: 19960129
Entered Medline: 19950831

L1 ANSWER 21 OF 81 MEDLINE on STN
TI The mercury-sensitive residue at cysteine 189 in the CHIP28 water channel.
AB Water channels provide the plasma membranes of red cells and renal proximal tubules with high permeability to water, thereby permitting water to move in the direction of an osmotic gradient. Molecular identification of CHIP28 **protein** as the membrane water channel was first accomplished by measurement of osmotic swelling of Xenopus oocytes injected with CHIP28 RNA (Preston, G.M., Carroll, T.P., Guggino, W.B., and Agre, P. (1992) Science 256, 385-387). Since water channels are pharmacologically inhibited by submillimolar concentrations of Hg2+, site-directed mutagenesis was undertaken to demonstrate which of the 4 cysteines (87, 102, 152, or 189) is the Hg(2+)-sensitive residue in the CHIP28 molecule. Each cysteine was individually replaced by serine, and oocytes expressing each of the four mutants exhibited osmotic water permeability (Pf) equivalent to wild-type CHIP28. After incubation in HgCl2, all were significantly inhibited, except C189S exists as a multisubunit complex in the native membrane; however, although oocytes injected with mixed CHIP28 and C189S RNAs exhibited Pf corresponding to the sum of their individual activities, exposure to Hg2+ only reduced the Pf to the level of the C189S mutant. Of the six substitutions at residue

189, only the serine and alanine mutants exhibited increased Pf and had glycosylation patterns resembling wild-type CHIP28 on immunoblots. These studies demonstrated: (i) CHIP28 **water channel activity** is retained despite substitution of individual cysteines with serine; (ii) cysteine 189 is the Hg(2+)-sensitive residue; (iii) the subunits of the CHIP28 complex are individually active water pores; (iv) residue 189 is critical to proper processing of the CHIP28 **protein**
.

ACCESSION NUMBER: 93106996 MEDLINE
DOCUMENT NUMBER: 93106996 PubMed ID: 7677994
TITLE: The mercury-sensitive residue at cysteine 189 in the CHIP28 water channel.
AUTHOR: Preston G M; Jung J S; Guggino W B; Agre P
CORPORATE SOURCE: Department of Medicine and Cell Biology/Anatomy, Johns Hopkins University School of Medicine, Baltimore, Maryland 21205.
CONTRACT NUMBER: DK32753 (NIDDK)
HL33991 (NHLBI)
HL48268 (NHLBI)
+
SOURCE: JOURNAL OF BIOLOGICAL CHEMISTRY, (1993 Jan 5) 268 (1) 17-20.
Journal code: 2985121R. ISSN: 0021-9258.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199301
ENTRY DATE: Entered STN: 19930212
Last Updated on STN: 20000303
Entered Medline: 19930128

L1 ANSWER 22 OF 81 MEDLINE on STN
TI A 30 kDa functional size for the erythrocyte water channel determined in situ by radiation inactivation.
AB The functional unit size of the water channel in rabbit erythrocytes was assessed using target size analysis following radiation inactivation. Using Radiochromic nylon dosimetry, accurate values of accumulated dose yielded an absolute target analysis, leading to direct determination of molecular size. The erythrocyte water channel functional size was shown to be 30 kDa, and is identical to the size found in rat renal proximal tubule brush border membranes (1), suggesting close homology of these two water channels. The result suggests that the 28 kDa channel-like intrinsic **protein** (CHIP28) recently isolated from human erythrocytes and proximal tubule (2), which is believed to form water channels of oligomeric construction may have a functional **water channel activity** in monomeric form.

ACCESSION NUMBER: 92272727 MEDLINE
DOCUMENT NUMBER: 92272727 PubMed ID: 1375458
TITLE: A 30 kDa functional size for the erythrocyte water channel determined in situ by radiation inactivation.
AUTHOR: Van Hoek A N; Luthjens L H; Hom M L; Van Os C H; Dempster J A
CORPORATE SOURCE: Department of Physiology, University of Nijmegen, The Netherlands.
SOURCE: BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS, (1992 May 15) 184 (3) 1331-8.
Journal code: 0372516. ISSN: 0006-291X.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199206
ENTRY DATE: Entered STN: 19920710

Last Updated on STN: 19970203
Entered Medline: 19920623

L1 ANSWER 23 OF 81 MEDLINE on STN
TI Role of glucose carrier in human erythrocyte water permeability.
AB Although the transport properties of human erythrocyte water channels have been well characterized, the identity of the **protein**(s) mediating water flow remains unclear. Recent evidence that glucose carriers can conduct water raised the possibility that the glucose carrier, which is abundant in human erythrocytes, is the water channel. To test this possibility, water permeabilities and glucose fluxes were measured in large unilamellar vesicles (LUV) containing human erythrocyte lipid alone (lipid LUV), reconstituted purified human erythrocyte glucose carrier (Glut1 LUV), or reconstituted glucose carrier in the presence of other human erythrocyte ghost proteins (ghost LUV). In glucose and ghost LUV, glucose carriers were present at 25% of the density of native erythrocytes, were oriented randomly in the bilayer, and exhibited characteristic inhibition of glucose flux when exposed to cytochalasin B. Osmotic water permeability (Pf, in centimeters per second; n = 4) averaged 0.0012 +/- 0.00033 in lipid LUV, 0.0032 +/- 0.0015 in Glut1 LUV, and 0.006 +/- 0.0014 in ghost LUV. Activation energies of water flow for the three preparations ranged between 10 and 13 kcal/mol; p-(chloromercuri)benzenesulfonate (pCMBS), an organic mercurial inhibitor of erythrocyte water channels, and cytochalasin B did not alter Pf. These results indicate that reconstitution of glucose carriers at high density increases water permeability but does not result in **water channel activity**. However, because the turnover number of reconstituted carriers is reduced from that of native carriers, experiments were also performed on erythrocyte ghosts with intact water channel function. In ghosts, Pf averaged 0.038 +/- 0.013 (n = 9), while the activation energy for water flow averaged 3.0 +/- 0.3 kcal/mol.(ABSTRACT TRUNCATED AT 250 WORDS)

ACCESSION NUMBER: 92118860 MEDLINE
DOCUMENT NUMBER: 92118860 PubMed ID: 1370631
TITLE: Role of glucose carrier in human erythrocyte water permeability.
AUTHOR: Zeidel M L; Albalak A; Grossman E; Carruthers A
CORPORATE SOURCE: Department of Medicine, West Roxbury Veterans Administration Medical Center, Massachusetts 02132.
CONTRACT NUMBER: RO-1 DK36081 (NIDDK)
RO-1 DK43955 (NIDDK)
SOURCE: BIOCHEMISTRY, (1992 Jan 21) 31 (2) 589-96.
Journal code: 0370623. ISSN: 0006-2960.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 199202
ENTRY DATE: Entered STN: 19920315
Last Updated on STN: 19960129
Entered Medline: 19920226

L1 ANSWER 24 OF 81 USPATFULL on STN
TI Novel antibodies that bind to antigenic polypeptides, nucleic acids encoding the antigens, and methods of use
AB Disclosed herein are nucleic acid sequences that encode polypeptides. Also disclosed are antibodies, which immunospecifically-bind to the polypeptide, as well as derivatives, variants, mutants, or fragments of the aforementioned polypeptide, polynucleotide, or antibody. The invention further discloses therapeutic, diagnostic and research methods for diagnosis, treatment, and prevention of disorders involving any one of these novel human nucleic acids, polypeptides, or antibodies, or fragments thereof.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

ACCESSION NUMBER: 2003:295021 USPATFULL

TITLE: Novel antibodies that bind to antigenic polypeptides, nucleic acids encoding the antigens, and methods of use

INVENTOR(S): Padigaru, Muralidhara, Branford, CT, UNITED STATES
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Patturajan, Meera, Branford, CT, UNITED STATES
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Taupier, Raymond J., JR., East Haven, CT, UNITED STATES

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 2003208039	A1	20031106	
APPLICATION INFO.:	US 2002-93463	A1	20020308	(10)

	NUMBER	DATE	
PRIORITY INFORMATION:	US 2001-274322P	20010308	(60)
	US 2001-283675P	20010413	(60)
	US 2001-338092P	20011203	(60)
	US 2001-274281P	20010308	(60)
	US 2001-274101P	20010307	(60)
	US 2001-325681P	20010927	(60)
	US 2001-304354P	20010710	(60)
	US 2001-279995P	20010330	(60)
	US 2001-294899P	20010531	(60)
	US 2001-287424P	20010430	(60)
	US 2001-299027P	20010618	(60)
	US 2001-309198P	20010731	(60)
	US 2001-281194P	20010403	(60)
	US 2001-274194P	20010308	(60)
	US 2001-274849P	20010309	(60)
	US 2001-330380P	20011018	(60)
	US 2001-275235P	20010312	(60)
	US 2001-288342P	20010503	(60)
	US 2001-275578P	20010313	(60)
	US 2001-291240P	20010516	(60)
	US 2001-294485P	20010530	(60)
	US 2001-299310P	20010619	(60)

US 2001-275579P	20010313	(60)
US 2001-275601P	20010313	(60)
US 2001-276000P	20010314	(60)
US 2001-280900P	20010402	(60)
US 2001-276776P	20010316	(60)
US 2001-294889P	20010531	(60)
US 2001-318770P	20010912	(60)
US 2001-276994P	20010319	(60)
US 2001-277338P	20010320	(60)
US 2001-325430P	20010927	(60)
US 2001-332094P	20011121	(60)
US 2001-299303P	20010619	(60)
US 2001-288066P	20010502	(60)
US 2001-277321P	20010320	(60)
US 2001-280822P	20010402	(60)
US 2001-277239P	20010320	(60)
US 2001-277327P	20010320	(60)
US 2001-277791P	20010321	(60)
US 2001-333184P	20011114	(60)
US 2001-277833P	20010322	(60)
US 2001-318462P	20010910	(60)
US 2001-288528P	20010503	(60)
US 2001-278152P	20010323	(60)
US 2001-332272P	20011114	(60)
US 2001-278894P	20010326	(60)
US 2001-312903P	20010816	(60)
US 2001-333272P	20011114	(60)
US 2001-279036P	20010327	(60)
US 2001-332172P	20011114	(60)
US 2001-337426P	20011203	(60)
US 2001-278999P	20010327	(60)
US 2001-279344P	20010328	(60)
US 2001-332271P	20011114	(60)
US 2001-291099P	20010516	(60)
US 2001-291190P	20010515	(60)
US 2001-280233P	20010330	(60)
US 2001-280802P	20010402	(60)
US 2001-335301P	20011031	(60)
US 2001-337185P	20011204	(60)
US 2002-345705P	20020103	(60)

DOCUMENT TYPE: Utility
FILE SEGMENT: APPLICATION
LEGAL REPRESENTATIVE: Ivor R. Elrifi, Esq., MINTZ, LEVIN, COHN, FERRIS,, GLOVSKY and POPEO, P.C., One Financial Center, Boston, MA, 02111
NUMBER OF CLAIMS: 38
EXEMPLARY CLAIM: 1
LINE COUNT: 29786
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 25 OF 81 USPATFULL on STN
TI Novel polypeptide having **water channel activity** and DNA sequence
AB The present invention has its objects to provide a novel polypeptide having **water channel activity** and to a DNA sequence encoding for the polypeptide.

This invention is related to a novel polypeptide having **water channel activity** which has the amino acid sequence, within the molecule thereof, shown in the sequence listing under SEQ ID NO: 1.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
ACCESSION NUMBER: 2002:228448 USPATFULL

TITLE: Novel polypeptide having **water channel activity** and DNA sequence

INVENTOR(S): Okubo, Kousaku, Mino-shi, JAPAN
Kuriyama, Hiroshi, Toyonaka-shi, JAPAN
Mita, Shiro, Ashiya-shi, JAPAN
Ishida, Naruhiro, Ikoma-shi, JAPAN

	NUMBER	KIND	DATE
PATENT INFORMATION:	US 2002123611	A1	20020905
APPLICATION INFO.:	US 2001-849980	A1	20010508 (9)

RELATED APPLN. INFO.: Division of Ser. No. US 1999-381810, filed on 19 Oct 1999, GRANTED, Pat. No. US 6252046 A 371 of International Ser. No. WO 1998-JP1371, filed on 27 Mar 1998, UNKNOWN

	NUMBER	DATE
PRIORITY INFORMATION:	JP 1997-94845	19970328

DOCUMENT TYPE: Utility
FILE SEGMENT: APPLICATION
LEGAL REPRESENTATIVE: Burton A. Amernick, Connolly Bove Lodge & Hutz LLP, Suite 800, 1990 M Street, N.W., Washington, DC, 20036-3425
NUMBER OF CLAIMS: 4
EXEMPLARY CLAIM: 1
LINE COUNT: 451
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 26 OF 81 USPATFULL on STN
TI Maize aquaporins and uses thereof
AB The invention provides isolated maize aquaporin nucleic acids and their encoded proteins. The present invention provides methods and compositions relating to altering aquaporin concentration and/or composition of plants. The invention further provides recombinant expression cassettes, host cells, transgenic plants, and antibody compositions.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
ACCESSION NUMBER: 2001:197264 USPATFULL
TITLE: Maize aquaporins and uses thereof
INVENTOR(S): Jung, Rudolf, Des Moines, IA, United States
Chaumont, Francois, Louvain-la-Neuve, Belgium
Chrispeels, Maarten, La Jolla, CA, United States
PATENT ASSIGNEE(S): Pioneer Hi-Bred International, Inc., Des Moines, IA, United States (U.S. corporation)
The Regents of the University of California, Oakland, CA, United States (U.S. corporation)

	NUMBER	KIND	DATE
PATENT INFORMATION:	US 6313376	B1	20011106
APPLICATION INFO.:	US 1999-372448		19990811 (9)

	NUMBER	DATE
PRIORITY INFORMATION:	US 1998-96627P	19980814 (60)

DOCUMENT TYPE: Utility
FILE SEGMENT: GRANTED
PRIMARY EXAMINER: Fox, David T.
ASSISTANT EXAMINER: Ibrahim, Medina A.
LEGAL REPRESENTATIVE: Pioneer Hi-Bred International, Inc.
NUMBER OF CLAIMS: 40
EXEMPLARY CLAIM: 1,4,5,8,13

LINE COUNT: 3369
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 27 OF 81 USPATFULL on STN
TI Polypeptide having **water channel activity** and DNA sequence
AB The present invention has its objects to provide a novel polypeptide having **water channel activity** and to a DNA sequence encoding for the polypeptide.

This invention is related to a novel polypeptide having **water channel activity** which has the amino acid sequence, within the molecule thereof, shown in the sequence listing under SEQ ID NO:1.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
ACCESSION NUMBER: 2001:98066 USPATFULL
TITLE: Polypeptide having **water channel activity** and DNA sequence
INVENTOR(S): Okubo, Kousaku, Mino, Japan
Kuriyama, Hiroshi, Toyonaka, Japan
Mita, Shiro, Ashiya, Japan
Ishida, Naruhiro, Ikoma, Japan
PATENT ASSIGNEE(S): Santen Pharmaceutical Co., Ltd., Osaka, Japan (non-U.S. corporation)

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 6252046	B1	20010626	
	WO 9843997		19980327	
APPLICATION INFO.:	US 1999-381810		19991019	(9)
	WO 1998-JP1371		19980327	
			19991019	PCT 371 date
			19991019	PCT 102(e) date

	NUMBER	DATE
PRIORITY INFORMATION:	JP 1997-94845	19970328

DOCUMENT TYPE: Utility
FILE SEGMENT: GRANTED
PRIMARY EXAMINER: Carlson, Karen Cochrane
ASSISTANT EXAMINER: Robinson, Hope A.
LEGAL REPRESENTATIVE: Connolly Bove Lodge & Hutz
NUMBER OF CLAIMS: 2
EXEMPLARY CLAIM: 1
LINE COUNT: 327
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 28 OF 81 USPATFULL on STN
TI Isolation, cloning and expression of transmembrane water channel Aquaporin 5 (AQP5)
AB A transmembrane water channel **protein** is isolated in highly purified form from human erythrocytes. An identical **protein** is also found in kidney tubules. cDNA encoding this **protein** has been isolated and its amino acid sequence determined. cDNA encoding a transmembrane water channel **protein** has also been obtained from salivary gland, and an identical **protein** is found in lacrimal gland, cornea, and lung tissue. The amino acid sequence of the **protein** has been deduced from the cDNA, and the **protein** has been designated Aquaporin-5. Using the nucleic acid or **protein** sequence provided herein, the **protein** may be produced by recombinant DNA techniques. Expression of the **protein** may be determined by either immunoassay or in situ hybridization assay.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
ACCESSION NUMBER: 1999:4368 USPATFULL
TITLE: Isolation, cloning and expression of transmembrane water channel Aquaporin 5 (AQP5)
INVENTOR(S): Agre, Peter C., Baltimore, MD, United States
PATENT ASSIGNEE(S): The Johns Hopkins University, Baltimore, MD, United States (U.S. corporation)

	NUMBER	KIND	DATE
PATENT INFORMATION:	US 5858702		19990112
APPLICATION INFO.:	US 1995-393996		19950224 (8)

RELATED APPLN. INFO.: Continuation-in-part of Ser. No. US 1992-930168, filed on 17 Aug 1992, now abandoned which is a continuation-in-part of Ser. No. US 1991-806273, filed on 13 Dec 1991, now abandoned
DOCUMENT TYPE: Utility
FILE SEGMENT: Granted
PRIMARY EXAMINER: Walsh, Stephen
ASSISTANT EXAMINER: Basham, Daryl A.
LEGAL REPRESENTATIVE: Banner & Witcoff, Ltd.
NUMBER OF CLAIMS: 5
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 29 Drawing Figure(s); 20 Drawing Page(s)
LINE COUNT: 2355
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 29 OF 81 USPATFULL on STN
TI Isolation cloning and expression of transmembrane water channel aquaporin 1(AQP1)
AB A transmembrane water channel **protein** is isolated in highly purified form from human erythrocytes. An identical **protein** is also found in kidney tubules. cDNA encoding this **protein** has been isolated and its amino acid sequence determined. cDNA encoding a transmembrane water channel **protein** has also been obtained from salivary gland, and an identical **protein** is found in lacrimal gland, cornea, and lung tissue. The amino acid sequence of the **protein** has been deduced from the cDNA, and the **protein** has been designated Aquaporin-5. Using the nucleic acid or **protein** sequence provided herein, the **protein** may be produced by recombinant DNA techniques. Expression of the **protein** may be determined by either immunoassay or in situ hybridization assay.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
ACCESSION NUMBER: 1998:42243 USPATFULL
TITLE: Isolation cloning and expression of transmembrane water channel aquaporin 1(AQP1)
INVENTOR(S): Agre, Peter C., Baltimore, MD, United States
PATENT ASSIGNEE(S): The Johns Hopkins University, Baltimore, MD, United States (U.S. corporation)

	NUMBER	KIND	DATE
PATENT INFORMATION:	US 5741671		19980421
APPLICATION INFO.:	US 1995-468763		19950606 (8)

RELATED APPLN. INFO.: Division of Ser. No. US 1995-393996, filed on 24 Feb 1995 which is a continuation-in-part of Ser. No. US 1992-930168, filed on 17 Aug 1992, now abandoned which is a continuation-in-part of Ser. No. US 1991-806723, filed on 12 Dec 1991, now patented, Pat. No. US 5191330
DOCUMENT TYPE: Utility
FILE SEGMENT: Granted

PRIMARY EXAMINER: Walsh, Stephen
ASSISTANT EXAMINER: Basham, Daryl A.
LEGAL REPRESENTATIVE: Banner & Witcoff, Ltd.
NUMBER OF CLAIMS: 5
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 29 Drawing Figure(s); 20 Drawing Page(s)
LINE COUNT: 2332
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L1 ANSWER 30 OF 81 DGENE COPYRIGHT 2004 THOMSON DERWENT on STN
TI Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
AN AAW87644 Protein DGENE
AB The present sequence represents a **protein** with **water channel activity**. The polypeptide can be used for treatment of water and lipid metabolism-associated diseases.
ACCESSION NUMBER: AAW87644 Protein DGENE
TITLE: Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
INVENTOR: Ishida N; Kuriyama H; Mita S; Okubo K
PATENT ASSIGNEE: (SANT)SANTEN PHARM CO LTD.
PATENT INFO: WO 9843997 A1 19981008 19p
APPLICATION INFO: WO 1998-JP1371 19980327
PRIORITY INFO: JP 1997-94845 19970328
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
OTHER SOURCE: 1998-557092 [47]
CROSS REFERENCES: N-PSDB: AAV83992
DESCRIPTION: A **protein** with **water channel activity**.

L1 ANSWER 31 OF 81 DGENE COPYRIGHT 2004 THOMSON DERWENT on STN
TI Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
AN AAV83993 DNA DGENE
AB PCR primers AAV83993-94 were used to amplify nucleic acid encoding a **protein** with **water channel activity** . The polypeptide can be used for treatment of water and lipid metabolism-associated diseases.
ACCESSION NUMBER: AAV83993 DNA DGENE
TITLE: Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
INVENTOR: Ishida N; Kuriyama H; Mita S; Okubo K
PATENT ASSIGNEE: (SANT)SANTEN PHARM CO LTD.
PATENT INFO: WO 9843997 A1 19981008 19p
APPLICATION INFO: WO 1998-JP1371 19980327
PRIORITY INFO: JP 1997-94845 19970328
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
OTHER SOURCE: 1998-557092 [47]
DESCRIPTION: PCR primer SK used to amplify **water channel activity protein** DNA.

L1 ANSWER 32 OF 81 DGENE COPYRIGHT 2004 THOMSON DERWENT on STN
TI Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
AN AAV83994 DNA DGENE
AB PCR primers AAV83993-94 were used to amplify nucleic acid encoding a **protein** with **water channel activity**

. The polypeptide can be used for treatment of water and lipid metabolism-associated diseases.

ACCESSION NUMBER: AAV83994 DNA DGENE
TITLE: Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
INVENTOR: Ishida N; Kuriyama H; Mita S; Okubo K
PATENT ASSIGNEE: (SANT) SANTEN PHARM CO LTD.
PATENT INFO: WO 9843997 A1 19981008 19p
APPLICATION INFO: WO 1998-JP1371 19980327
PRIORITY INFO: JP 1997-94845 19970328
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
OTHER SOURCE: 1998-557092 [47]
DESCRIPTION: PCR primer T7 used to amplify **water channel activity protein** DNA.

L1 ANSWER 33 OF 81 DGENE COPYRIGHT 2004 THOMSON DERWENT on STN
TI Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
AN AAV83992 cDNA to mRNA DGENE
AB The present sequence encodes a **protein** with **water channel activity**. The polypeptide can be used for treatment of water and lipid metabolism-associated diseases.

ACCESSION NUMBER: AAV83992 cDNA to mRNA DGENE
TITLE: Novel human lipid polypeptide of aquaporine family with **water channel activity** - useful for treating water and lipid metabolism-associated diseases
INVENTOR: Ishida N; Kuriyama H; Mita S; Okubo K
PATENT ASSIGNEE: (SANT) SANTEN PHARM CO LTD.
PATENT INFO: WO 9843997 A1 19981008 19p
APPLICATION INFO: WO 1998-JP1371 19980327
PRIORITY INFO: JP 1997-94845 19970328
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
OTHER SOURCE: 1998-557092 [47]
CROSS REFERENCES: P-PSDB: AAW87644
DESCRIPTION: Nucleic acid encoding a **protein** with **water channel activity**.

L1 ANSWER 34 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.
AB The aquaporin PM28A is one of the major integral proteins in spinach leaf plasma membranes. Phosphorylation/dephosphorylation of Ser274 at the C-terminus and of Ser115 in the first cytoplasmic loop has been shown to regulate the **water channel activity** of PM28A when expressed in Xenopus oocytes. To understand the mechanisms of the phosphorylation-mediated gating of the channel the structure of PM28A is required. In a first step we have used the methylotrophic yeast Pichia pastoris for expression of the pm28a gene. The expressed **protein** has a molecular mass of 32462 Da as determined by matrix-assisted laser desorption ionization-mass spectrometry, forms tetramers as revealed by electron microscopy and is functionally active when reconstituted in proteoliposomes. PM28A was efficiently solubilized from urea- and alkali-stripped Pichia membranes by octyl-β-D-thioglucopyranoside resulting in a final yield of 25 mg of purified **protein** per liter of cell culture.

ACCESSION NUMBER: 2003090111 EMBASE
TITLE: Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.

AUTHOR: Karlsson M.; Fotiadis D.; Sjovall S.; Johansson I.; Hedfalk K.; Engel A.; Kjellbom P.
CORPORATE SOURCE: P. Kjellbom, Department of Plant Biochemistry, Lund University, Box 124, S-22100 Lund, Sweden. per.kjellbom@plantbio.lu.se
SOURCE: FEBS Letters, (27 Feb 2003) 537/1-3 (68-72).
Refs: 28
ISSN: 0014-5793 CODEN: FEBLAL
COUNTRY: Netherlands
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 004 Microbiology
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 35 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI 2,3-Butanedione monoxime (BDM), a potent inhibitor of actin-myosin interaction, induces ion and fluid transport in MDCK monolayers.
AB Membrane-cytoskeleton interactions have been shown to be crucial to modulate polarity, cell shape and the paracellular pathway in epithelial MDCK cell monolayers. In particular, actin organization and myosin-dependent contractility play an important role in the regulation of these functions. Participation of myosin in vectorial transport, expressed as formation of domes, was investigated in confluent monolayers of high transepithelial electrical resistance (TER) plated on non-permeable supports. Cells exposed to 2,3-butanedione monoxime, a selective inhibitor of myosin ATPase, showed a remarkable increase in the number of domes. Replacement of extracellular Na(+) and Cl(-) and inhibition of Na(+)-K(+)-ATPase blocked the induction of domes. The monoxime also caused a reduction of the TER leading to an increase in the paracellular flux of small molecular weight dextran. However, immunofluorescence microscopy of drug-treated cells showed that the localization and staining pattern of tight junction proteins ZO-1, occludin, and claudin 1, or the actin-myosin ring at the zonula adherens, were not modified. Treatment with the drug produced striking re-arrangements of actin filaments at the microvilli and at the basal level of the cells. Our data show that disruption of actin-myosin interaction at several cellular sites contributed importantly to the increased transport activity and the formation of the domes. These results point to the relevant role for actin-myosin dynamics and actin organization in the regulation of ion and **water channel activity** in these cells.
ACCESSION NUMBER: 2002433468 EMBASE
TITLE: 2,3-Butanedione monoxime (BDM), a potent inhibitor of actin-myosin interaction, induces ion and fluid transport in MDCK monolayers.
AUTHOR: Castillo A.M.; Reyes J.L.; Sanchez E.; Mondragon R.; Meza I.
CORPORATE SOURCE: I. Meza, Department of Biomedicina Molecular, Ctro. Invest./Estud. Avanzados IPN, Apartado 14-740, Mexico DF 07000, Mexico. imeza@mail.cinvestav.mx
SOURCE: Journal of Muscle Research and Cell Motility, (2002) 23/3 (223-234).
Refs: 51
ISSN: 0142-4319 CODEN: JMRMD3
COUNTRY: Netherlands
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 002 Physiology
029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 36 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Existence of a tightly regulated water channel in saccharomyces

cerevisiae.

AB The Saccharomyces cerevisiae strain σ1278b possesses two putative aquaporins, Aqy1-1p and Aqy2-1p. Previous work demonstrated that Aqy1-1p functions as a water channel in Xenopus oocyte. However, no function could be attributed to Aqy2-1p in this system. Specific antibodies were used to follow the expression of Aqy1-1p and Aqy2-1p in the yeast. Aqy1-1p was never detected whatever the growth phase and culture conditions tested. In contrast, Aqy2-1p was detected only during the exponential growth phase in rich medium containing glucose. Aqy2-1p expression was repressed by hyper-osmotic culture conditions. Both immunocytochemistry and biochemical subcellular fractionation demonstrated that Aqy2-1p is located on the endoplasmic reticulum (ER) as well as on the plasma membrane. In microsomal vesicles enriched in ER, a **water channel activity** due to Aqy2-1p was detected by stopped-flow analysis. Our results show that the expression of aquaporins is tightly controlled. The physiological relevance of aquaporin-mediated water transport in yeast is discussed.

ACCESSION NUMBER: 2001327784 EMBASE
TITLE: Existence of a tightly regulated water channel in saccharomyces cerevisiae.
AUTHOR: Meyrial V.; Laize V.; Gobin R.; Ripoche P.; Hohmann S.; Tacnet F.
CORPORATE SOURCE: F. Tacnet, Dept. de Biol. Cellulaire et Molec., SBCe, CEA /Saclay, Gif sur Yvette Cedex F-91191, France. tacnet@dsvidf.cea.fr
SOURCE: European Journal of Biochemistry, (2001) 268/2 (334-343). Refs: 30
ISSN: 0014-2956 CODEN: EJBCAI
COUNTRY: United Kingdom
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 004 Microbiology
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 37 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN

TI Highly selective **water channel activity** measured by voltage clamp: Analysis of planar lipid bilayers reconstituted with purified AqpZ.

AB Aquaporins are membrane channels selectively permeated by water or water plus glycerol. Conflicting reports have described ion conductance associated with some water channels, raising the question of whether ion conductance is a general property of the aquaporin family. To clarify this question, a defined system was developed to simultaneously measure water permeability and ion conductance. The Escherichia coli water channel aquaporin-Z (AqpZ) was studied, because it is a highly stable tetramer. Planar lipid bilayers were formed from unilamellar vesicles containing purified AqpZ. The hydraulic conductivity of bilayers made from the total extract of E. coli lipids increased 3-fold if reconstituted with AqpZ, but electric conductance was unchanged. No channel activity was detected under voltage-clamp conditions, indicating that less than one in 10(9) transport events is electrogenic. Microelectrode measurements were simultaneously undertaken adjacent to the membrane. Changes in sodium concentration profiles accompanying transmembrane water flow permitted calculation of the activation energies: 14 kcal/mol for **protein**-free lipid bilayers and 4 kcal/mol for lipid bilayers containing AqpZ. Neither the water permeability nor the electric conductivity exhibited voltage dependence. This sensitive system demonstrated that AqpZ is permeated by water but not charged ions and should permit direct analyses of putative electrogenic properties of other aquaporins.

ACCESSION NUMBER: 2001295739 EMBASE
TITLE: Highly selective **water channel activity** measured by voltage clamp: Analysis of planar lipid bilayers reconstituted with purified AqpZ.

AUTHOR: Pohl P.; Saparov S.M.; Borgnia M.J.; Agre P.
CORPORATE SOURCE: P. Pohl, Forschungsinstitut Molek. Pharmakol., Nachwuchsgruppe Biophysik, Robert-Roessle-Strasse 10, 13125 Berlin, Germany. pohl@fmp-berlin.de
SOURCE: Proceedings of the National Academy of Sciences of the United States of America, (14 Aug 2001) 98/17 (9624-9629). Refs: 44
ISSN: 0027-8424 CODEN: PNASA6
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 004 Microbiology
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 38 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Identification of sequence determinants that direct different intracellular folding pathways for aquaporin-1 and aquaporin-4.
AB Homologous aquaporin water channels utilize different folding pathways to acquire their transmembrane (TM) topology in the endoplasmic reticulum (ER). AQP4 acquires each of its six TM segments via cotranslational translocation events, whereas AQP1 is initially synthesized with four TM segments and subsequently converted into a six membrane-spanning topology. To identify sequence determinants responsible for these pathways, peptide segments from AQP1 and AQP4 were systematically exchanged. Chimeric proteins were then truncated, fused to a C-terminal translocation reporter, and topology was analyzed by protease accessibility. In each chimeric context, TM1 initiated ER targeting and translocation. However, AQP4-TM2 cotranslationally terminated translocation, while AQP1-TM2 failed to terminate translocation and passed into the ER lumen. This difference in stop transfer activity was due to two residues that altered both the length and hydrophobicity of TM2 (Asn49 and Lys51 in AQP1 versus Met48 and Leu50 in AQP4). A second peptide region was identified within the TM3-4 peptide loop that enabled AQP4-TM3 but not AQP1-TM3 to reinitiate translocation and cotranslationally span the membrane. Based on these findings, it was possible to convert AQP1 into a cotranslational biogenesis mode similar to that of AQP4 by substituting just two peptide regions at the N terminus of TM2 and the C terminus of TM3. Interestingly, each of these substitutions disrupted **water channel activity**. These data thus establish the structural basis for different AQP folding pathways and provide evidence that variations in cotranslational folding enable polytopic proteins to acquire and/or maintain primary sequence determinants necessary for function.
ACCESSION NUMBER: 2000392658 EMBASE
TITLE: Identification of sequence determinants that direct different intracellular folding pathways for aquaporin-1 and aquaporin-4.
AUTHOR: Foster W.; Helm A.; Turnbull I.; Gulati H.; Yang B.; Verkman A.S.; Skach W.R.
CORPORATE SOURCE: W.R. Skach, Div. of Molecular Medicine, Oregon Health Sciences University, 3181 S.W. Sam Jackson Park Rd., Portland, OR 97201, United States. skachw@ohsu.edu
SOURCE: Journal of Biological Chemistry, (3 Nov 2000) 275/44 (34157-34165). Refs: 71
ISSN: 0021-9258 CODEN: JBCHA3
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 39 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN

TI Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.

AB Opacities in the crystalline lens of eye appear with high frequency in the general population. Dominantly inherited cataracts with differing clinical features were found in two families carrying different point mutations in the gene encoding lens water channel **protein** AQP0 (major intrinsic **protein**, MIP). Families with E134G have a uni-lamellar cataract which is stable after birth, whereas families with T138R have multi-focal opacities which increase throughout life. To establish pathophysiological relevance of cataract formation, the Xenopus laevis oocyte expression system was employed to evaluate functional defects in the mutant proteins, E134G and T138R. Both substitutions cause loss of membrane **water channel activity** due to impaired trafficking of the mutant proteins to the oocyte plasma membrane. Although missense mutations in AQP1 and AQP2 proteins are known to result in recessive traits in vivo and in vitro, when E134G or T138R are co-expressed with wild-type AQP0 **protein**, the mutant proteins exhibit dominant negative behaviour. To our knowledge, these studies represent the first in vitro demonstration of functionally defective AQP0 **protein** from humans with congenital cataracts. Moreover, these observations predict that less severe defects in the AQP0 **protein** may contribute to lens opacity in patients with common, less fulminant forms of cataracts.

ACCESSION NUMBER: 2000343932 EMBASE
TITLE: Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.
AUTHOR: Francis P.; Chung J.-J.; Yasui M.; Berry V.; Moore A.; Wyatt M.K.; Wistow G.; Bhattacharya S.S.; Agre P.
CORPORATE SOURCE: P. Agre, Department of Biological Chemistry, Johns Hopkins Univ. Sch. of Medicine, 75 North Wolfe Street, Baltimore, MD 21205-2185, United States. pagre@jhmi.edu
SOURCE: Human Molecular Genetics, (22 Sep 2000) 9/15 (2329-2334). Refs: 24
ISSN: 0964-6906 CODEN: HMGEE5
COUNTRY: United Kingdom
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 012 Ophthalmology
022 Human Genetics
029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 40 OF 81 EMBASE on STN

TI **Protein** kinase A-dependent phosphorylation of aquaporin-1.

AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. Previous results from our laboratory demonstrated that **water channel activity** of AQP1 was significantly increased by **protein** kinase A (PKA) activators such as cyclic-AMP (cAMP) and forskolin. The purpose of this study is to determine whether PKA-dependent **protein** phosphorylation is involved in the regulation of **water channel activity** of AQP1. Results presented here suggest that catalytic subunit of **protein** kinase A significantly increased the amount of phosphorylated AQP1 **protein**. In addition, these results indicated that cAMP-responsive redistribution of AQP1 may be regulated by phosphorylation of AQP1. Moreover, they provide new insights on the molecular mechanisms for regulating water balance in several tissues involving rapid water transport such as ciliary epithelium. In addition, they suggest important potential roles for AQP1 in several clinical disorders involving rapid water transport such as glaucoma. (C) 2000 Academic Press.

ACCESSION NUMBER: 2000231034 EMBASE
TITLE: **Protein** kinase A-dependent phosphorylation of aquaporin-1.
AUTHOR: Han Z.; Patil R.V.
CORPORATE SOURCE: R.V. Patil, Dept. Ophthalmology Visual Sciences, Washington University School Med., 660 South Euclid, St. Louis, MO 63110, United States. patil@am.seer.wustl.edu
SOURCE: Biochemical and Biophysical Research Communications, (24 Jun 2000) 273/1 (328-332).
Refs: 39
ISSN: 0006-291X CODEN: BBRCA
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 41 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
AB The water channel **protein** α-TIP is a member of the major intrinsic **protein** (MIP) membrane channel family. This aquaporin is found abundantly in vacuolar membranes of cotyledons (seed storage organs) and is synthesized during seed maturation. The **water channel activity** of α-TIP can be regulated by phosphorylation, and the **protein** may function in seed desiccation, cytoplasmic osmoregulation, and/or seed rehydration. α-TIP was purified from seed meal of the common bean (Phaseolus vulgaris) by membrane fractionation, solubilization in diheptanoylyhosphocholine and anion-exchange chromatography. Upon detergent removal and reconstitution into lipid bilayers, α-TIP crystallized as helical tubes. Electron cryo-crystallography of flattened tubes demonstrated that the crystals exhibit plane group p2 symmetry and c222 pseudosymmetry. Since the 2D crystals with p2 symmetry are derived from helical tubes, we infer that the unit of crystallization on the helical lattice is a dimer of tetramers. A projection density map at a resolution of 7.7 Å revealed that α-TIP assembles as a 60 Å x 60 Å square tetramer. Each subunit is formed by a heart-shaped ring comprised of density peaks which we interpret as α-helices. The similarity of this structure to mammalian plasma membrane MIP-family proteins suggests that the molecular design of functionally analogous and genetically homologous aquaporins is maintained between the plant and animal kingdoms.
ACCESSION NUMBER: 2000005575 EMBASE
TITLE: Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
AUTHOR: Daniels M.J.; Chrispeels M.J.; Yeager M.
CORPORATE SOURCE: M. Yeager, Division of Cardiovascular Diseases, Scripps Clinic, 10660 North Torrey Pines Road, La Jolla, CA 92037, United States. yeager@scripps.edu
SOURCE: Journal of Molecular Biology, (17 Dec 1999) 294/5 (1337-1349).
Refs: 65
ISSN: 0022-2836 CODEN: JMOBAK
COUNTRY: United Kingdom
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 42 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Transmembrane helix 5 is critical for the high water permeability of

aquaporin.

AB Aquaporin-2 (AQP2), a vasopressin-regulated water channel, plays a major role in urinary concentration. AQP2 and the major intrinsic **protein** (MIP) of lens fiber are highly homologous (58% amino acid identity) and share a topology of six transmembrane helices connected by five loops (loops A-E). Despite the similarities of these proteins, however, the **water channel activity** of AQP2 is much higher than that of MIP. To determine the site responsible for this gain of activity in AQP2, several parts of MIP were replaced with the corresponding parts of AQP2. When expressed in Xenopus oocytes, the osmotic water permeability (P(f)) of MIP and AQP2 was 48 and 245 x 10-4 cm/s, respectively. Substitutions in loops B-D failed to increase P(f), whereas substitution of loop E significantly increased P(f) 1.5-fold. A similar increase in P(f) was observed with the substitution of the front half of loop E. P(f) measurements taken in a yeast vesicle expression system also confirmed that loop E had a complementary effect, whereas loops B-D did not. However, P(f) values of the loop E chimeras were only .apprx.30% of that of AQP2. Simultaneous exchanges of loop E and a distal half of transmembrane helix 5 just proximal to loop E increased P(f) to the level of that of AQP2. Replacement of helix 5 alone stimulated P(f) 2.7-fold. Conversely, Pt was decreased by 73% when helix 5 of AQP2 was replaced with that of MIP. Moreover, P(f) was stimulated 2.6- and 3.3-fold after helix 5 of AQP1 and AQP4 was spliced into MIP, respectively. Our findings suggested that the distal half of helix 5 is necessary for maximum **water channel activity** in AQP. We speculate that this portion contributes to the formation of the aqueous pore and the determination of the flux rate.

ACCESSION NUMBER: 1999433469 EMBASE
TITLE: Transmembrane helix 5 is critical for the high water permeability of aquaporin.
AUTHOR: Kuwahara M.; Shinbo I.; Sato K.; Terada Y.; Marumo F.; Sasaki S.
CORPORATE SOURCE: M. Kuwahara, Second Dept. of Internal Medicine, School of Medicine, Tokyo Medical and Dental University, Tokyo 113-8519, Japan. mkuwmed2@med.tmd.ac.jp
SOURCE: Biochemistry, (7 Dec 1999) 38/49 (16340-16346).
Refs: 38
ISSN: 0006-2960 CODEN: BICHAW
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 43 OF 81 EMBASE
on STN

TI Progress on the structure and function of aquaporin 1.

AB Life exists in water as universal solvent, and cells need to deal with its influx and efflux. Nature has accomplished the almost impossible, creating membrane channels with both a high flux and a high specificity for water. The first water channel was discovered in red blood cell membranes. Today known as aquaporin-1, this channel was found to be closely related to the major integral **protein** (MIP)1 of the eye lens. Cloning and sequencing of numerous related proteins of the MIP family revealed the widespread occurrence of such channels, suggesting an essential physiological function. Their structures hold the clues to the remarkable **water channel activity**, as well as to the arrangement of transmembrane segments in general recent medium-resolution three-dimensional electron microscopic studies determined a tetrameric complex with six tilted transmembrane helices per monomer. The helices within each monomer surround a central density formed by two interhelical loops implicated by mutagenesis in the water channel function. A combination of sequence analysis and assignment of the observed densities to predicted helices provides a basis for speculation on the nature of the

water course through the **protein**. In particular, four highly conserved polar residues, E142-N192-N76-E17, are proposed to form a chain of key groups involved in the pathway of water flow through the channel.

ACCESSION NUMBER: 1998262377 EMBASE
TITLE: Progress on the structure and function of aquaporin 1.
AUTHOR: Heymann J.B.; Agre P.; Engel A.
CORPORATE SOURCE: J.B. Heymann, Inst. for Microsc. Struct. Biology, Biozentrum, University of Basel, CH-4056 Basel, Switzerland
SOURCE: Journal of Structural Biology, (1998) 121/2 (191-206).
Refs: 88
ISSN: 1047-8477 CODEN: JSBIEM
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 44 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Regulation of aquaporin-4 water channels by phorbol ester-dependent protein phosphorylation.
AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. However, because humans with defective AQP1 are phenotypically normal and because the ocular application of phorbol esters reduce intraocular pressure, we postulated that the **water channel activity** of AQP4 may be regulated by these agents. We now report that **protein** kinase C activators, phorbol 12,13- dibutyrate, and phorbol 12-myristate 13-acetate strongly stimulate the phosphorylation of AQP4 and inhibit its activity in a dose-dependent manner. Phorbol 12,13-dibutyrate (10 μM) and phorbol 12-myristate 13-acetate (10 nM) reduced the rate of AQP4-expressing oocyte swelling by 87 and 92%, respectively. Further, phorbol 12,13-dibutyrate significantly increased the amount of phosphorylated AQP4. These results demonstrate that protein kinase C can regulate the activity of AQP4 through a mechanism involving protein phosphorylation. Moreover, they suggest important potential roles for AQP4 in several clinical disorders involving rapid water transport such as glaucoma, brain edema, and swelling of premature infant lungs.

ACCESSION NUMBER: 1998105561 EMBASE
TITLE: Regulation of aquaporin-4 water channels by phorbol ester-dependent protein phosphorylation.
AUTHOR: Han Z.; Wax M.B.; Patil R.V.
CORPORATE SOURCE: R.V. Patil, Ophthalmology/Visual Sciences Dept., Washington Univ. School of Medicine, 660 South Euclid, St. Louis, MO 63110, United States. patil@am.seer.wustl.edu
SOURCE: Journal of Biological Chemistry, (13 Mar 1998) 273/11 (6001-6004).
Refs: 38
ISSN: 0021-9258 CODEN: JBCHA3
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 45 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AB Aquaporin 1 (AQP1), a six-transmembrane domain **protein** that functions as a water channel, is present in many fluid secreting and absorbing tissues such as kidney, brain, heart, and eye. It is believed

that among the five known mammalian aquaporins, kidney aquaporin (AQP2) is the only water channel that is regulated by arginine vasopressin (AVP). The present data suggest that AQP1 may also be regulated by AVP. The application of AVP to Xenopus oocytes injected with AQP1 cRNA increased the membrane permeability to water. In addition, our data reveal that atrial natriuretic peptide (ANP), a peptide hormone that plays an important role in the regulation of body fluid homeostasis, blocks the AQP1-mediated increase in water permeability. Incubation with 8-bromo-cAMP or direct 8-bromo-cAMP injection into oocytes expressing AQP1 cRNA significantly increased membrane permeability to water, suggesting that stimulation of AQP1 activity by AVP may involve a cAMP-dependent mechanism. Regulation of water permeability by AVP and ANP has potential relevance to active water transport in a variety of tissues that express AQP1 including kidney, brain, and eye.

ACCESSION NUMBER: 97333845 EMBASE
DOCUMENT NUMBER: 1997333845
TITLE: Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AUTHOR: Patil R.V.; Han Z.; Wax M.B.
CORPORATE SOURCE: R.V. Patil, Dept Ophthalmology Visual Sciences, Washington University, School of Medicine, 660 South Euclid, St. Louis, MO 63110, United States. patil@am.seer.wustl.edu
SOURCE: Biochemical and Biophysical Research Communications, (1997) 238/2 (392-396).
Refs: 43
ISSN: 0006-291X CODEN: BBRCA
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 46 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AB Aquaporin-3 (AQP3) is unique in its structure (lowest homology with other aquaporins) and in its function (significantly conductive to both small nonelectrolytes and water). However, there is a controversy among researchers on its water transport and induction by dehydration. We examined its localization and the effect of dehydration on its expression in the kidney, as well as its **water channel activity** when expressed in Xenopus oocytes. In vitro translation using reticulocyte lysate revealed that the size of rat AQP3 was 26 kDa, and the band shifted to around 31 kDa with microsomal fraction, which was sensitive to the digestion with N-glycosidase F. In Western blot analysis of rat kidney medulla, AQP3 appeared as a sharp band at 27 kDa and a broad band at 34-40 kDa. In immunohistochemistry, AQP3 was localized to principal cells and absent in intercalated cells in outer medulla. In inner medulla, AQP3 was restricted to inner medullary collecting duct (IMCD) cells. AQP3 was confined to the basolateral membrane of these cells. Although dehydration of rats for 2 days did not change the distribution pattern of AQP3 in IMCD cells, the dehydration increased AQP3 mRNA by twofold with slight increase of its **protein** level in kidney medulla. Finally, we confirmed its **water channel activity** when expressed in Xenopus oocytes. The human AQP3 stimulated osmotic water permeability by eightfold, which was inhibited by 0.3 mM mercury chloride by 34% and reversed by β- mercaptoethanol. Our results indicate that AQF3 is a glycosylated **protein** and a mercury-sensitive water channel localized at the basolateral membrane of principal cells and IMCD cells, and its expression is induced by dehydration at both **protein** and mRNA level.
ACCESSION NUMBER: 97274756 EMBASE

DOCUMENT NUMBER: 1997274756
TITLE: Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AUTHOR: Ishibashi K.; Sasaki S.; Fushimi K.; Yamamoto T.; Kuwahara M.; Marumo F.
CORPORATE SOURCE: K. Ishibashi, Second Dept. of Internal Medicine, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo, Tokyo 113, Japan
SOURCE: American Journal of Physiology - Renal Physiology, (1997) 272/2 41-2 (F235-F241).
Refs: 31
ISSN: 0363-6127 CODEN: AJPPFK
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 002 Physiology
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 47 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin α-TIP.
AB The vacuolar membrane **protein** α-TIP is a seed-specific **protein** of the Major Intrinsic **Protein** family. Expression of α-TIP in Xenopus oocytes confered a 4- to 8-fold increase in the osmotic water permeability (P(f)) of the oocyte plasma membrane, showing that α-TIP forms water channels and is thus a new aquaporin. α-TIP has three putative phosphorylation sites on the cytoplasmic side of the membrane (Ser7, Ser23 and Ser99), one of which (Ser7) has been shown to be phosphorylated. We present several lines of evidence that the activity of this aquaporin is regulated by phosphorylation. First, mutation of the putative phosphorylation sites in α-TIP (Ser7Ala, Ser23Ala and Ser99Ala) reduced the apparent water transport activity of α-TIP in oocytes, suggesting that phosphorylation of α-TIP occurs in the oocytes and participates in the control of **water channel activity**. Second, exposure of oocytes to the cAMP agonists 8-bromoadenosine 3',5'-cyclic monophosphate, forskolin and 3-isobutyl-methylxanthine, which stimulate endogenous **protein** kinase A (PKA), increased the water transport activity of α-TIP by 80-100% after 60 min. That the **protein** can be phosphorylated by PKA was demonstrated by phosphorylating or-TIP in isolated oocyte membranes with the bovine PKA catalytic subunit. Third, the integrity of the three sites at positions 7, 23 and 99 was necessary for the cAMP-dependent increase in the P(f) of oocytes expressing α-TIP as well as for in vitro phosphorylation of α-TIP. These findings demonstrate that the α-TIP water channel can be modulated via phosphorylation of Ser7, Ser23 and Ser99. To our knowledge, this is the first evidence of aquaporin regulation via phosphorylation and we propose this process as a mechanism for regulating water permeability of biological membranes.
ACCESSION NUMBER: 95211103 EMBASE
DOCUMENT NUMBER: 1995211103
TITLE: Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin α-TIP.
AUTHOR: Maurel C.; Kado R.T.; Guern J.; Chrispeels M.J.
CORPORATE SOURCE: Institut des Sciences Vegetales, CNRS,F-91198 Gif-sur-Yvette Cedex, France
SOURCE: EMBO Journal, (1995) 14/13 (3028-3035).
ISSN: 0261-4189 CODEN: EMJODG
COUNTRY: United Kingdom
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English

SUMMARY LANGUAGE: English

L1 ANSWER 48 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN

TI Concurrent expression of erythroid and renal aquaporin CHIP and appearance of **water channel activity** in perinatal rats.

AB Major phenotypic changes occur in red cell membranes during the perinatal period, but the underlying molecular explanations remain poorly defined. Aquaporin CHIP, the major erythroid and renal water channel, was studied in perinatal rats using affinity-purified anti-CHIP IgG for immunoblotting, flow cytometry, and immunofluorescence microscopy. CHIP was not detected in prenatal red cells but was first identified in circulating red cells on the third postnatal day. Most circulating red cells were positive for CHIP by the seventh postnatal day, and this proportion rose to nearly 100% by the 14th day. The ontogeny of red cell CHIP correlated directly with acquisition of osmotic water permeability and inversely with Arrhenius activation energy. Only minor alterations in the composition of red cell membrane lipids occurred at this time. Immunohistochemical analysis of perinatal kidneys demonstrated a major induction of CHIP in renal proximal tubules and descending thin limbs at birth, coincident with the development of renal concentration mechanisms. Therefore, water channels are unnecessary for oxygen delivery or survival in the prenatal circulation, however CHIP may confer red cells with the ability to rehydrate rapidly after traversing the renal medulla, which becomes hypertonic after birth.

ACCESSION NUMBER: 93304588 EMBASE
DOCUMENT NUMBER: 1993304588
TITLE: Concurrent expression of erythroid and renal aquaporin CHIP and appearance of **water channel activity** in perinatal rats.
AUTHOR: Smith B.L.; Baumgarten R.; Nielsen S.; Raben D.; Zeidel M.L.; Agre P.
CORPORATE SOURCE: Johns Hopkins Univ. Sch. of Medicine, 725 North Wolfe Street,Baltimore, MD, United States
SOURCE: Journal of Clinical Investigation, (1993) 92/4 (2035-2041). ISSN: 0021-9738 CODEN: JCINAO
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 002 Physiology
029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 49 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN

TI The mercury-sensitive residue at cysteine 189 in the CHIP28 water channel.

AB Water channels provide the plasma membranes of red cells and renal proximal tubules with high permeability to water, thereby permitting water to move in the direction of an osmotic gradient. Molecular identification of CHIP28 **protein** as the membrane water channel was first accomplished by measurement of osmotic swelling of Xenopus oocytes injected with CHIP28 RNA (Preston, G. M., Carroll, T. P., Guggino, W. B., and Agre, P. (1992) Science 256, 385-387). Since water channels are pharmacologically inhibited by submillimolar concentrations of Hg2+, site-directed mutagenesis was undertaken to demonstrate which of the 4 cysteines (87, 102, 152, or 189) is the Hg2+-sensitive residue in the CHIP28 molecule. Each cysteine was individually replaced by serine, and oocytes expressing each of the four mutants exhibited osmotic water permeability (P(f)) equivalent to wild-type CHIP28. After incubation in HgCl2, all were significantly inhibited, except C189S which was not inhibited even at 3 mM HgCl2. CHIP28 exists as a multisubunit complex in the native membrane; however, although oocytes injected with mixed CHIP28 and C189S RNAs exhibited P(f) corresponding to the sum of their individual activities, exposure to Hg2+ only reduced the P(f) to the level of the

C189S mutant. Of the six substitutions at residue 189, only the serine and alanine mutants exhibited increased P(f) and had glycosylation patterns resembling wild-type CHIP28 on immunoblots. These studies demonstrated: (i) CHIP28 **water channel activity** is retained despite substitution of individual cysteines with serine; (ii) cysteine 189 is the Hg2+-sensitive residue; (iii) the subunits of the CHIP28 complex are individually active water pores; (iv) residue 189 is critical to proper processing of the CHIP28 **protein**.

ACCESSION NUMBER: 93021279 EMBASE
DOCUMENT NUMBER: 1993021279
TITLE: The mercury-sensitive residue at cysteine 189 in the CHIP28 water channel.
AUTHOR: Preston G.M.; Jin Sup Jung; Guggino W.B.; Agre P.
CORPORATE SOURCE: Hunterian 103, J. Hopkins Univ. School of Medicine, 725 N. Wolfe St.,Baltimore, MD 21205, United States
SOURCE: Journal of Biological Chemistry, (1993) 268/1 (17-20). ISSN: 0021-9258 CODEN: JBCHA3
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 50 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI A 30 kDa functional size for the erythrocyte water channel determined in situ by radiation inactivation.
AB The functional unit size of the water channel in rabbit erythrocytes was assessed using target size analysis following radiation inactivation. Using Radiochromic nylon dosimetry, accurate values of accumulated dose yielded an absolute target analysis, leading to direct determination of molecular size. The erythrocyte water channel functional size was shown to be 30 kDa, and is identical to the size found in rat renal proximal tubule brush border membranes (1), suggesting close homology of these two water channels. The result suggests that the 28 kDa channel-like intrinsic **protein** (CHIP28) recently isolated from human erythrocytes and proximal tubule (2), which is believed to form water channels of oligomeric construction may have a functional **water channel activity** in monomeric form.

ACCESSION NUMBER: 92201290 EMBASE
DOCUMENT NUMBER: 1992201290
TITLE: A 30 kDa functional size for the erythrocyte water channel determined in situ by radiation inactivation.
AUTHOR: Van Hoek A.N.; Luthjens L.H.; Hom M.L.; Van Os C.H.; Dempster J.A.
CORPORATE SOURCE: Department of Physiology, University of Nijmegen, P.O. Box 9101,6500 HB Nijmegen, Netherlands
SOURCE: Biochemical and Biophysical Research Communications, (1992) 184/3 (1331-1338). ISSN: 0006-291X CODEN: BBRCA
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 002 Physiology
014 Radiology
025 Hematology
029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 51 OF 81 EMBASE COPYRIGHT 2004 ELSEVIER INC. ALL RIGHTS RESERVED. on STN
TI Role of glucose carrier in human erythrocyte water permeability.
AB Although the transport properties of human erythrocyte water channels have been well characterized, the identity of the **protein**(s)

mediating water flow remains unclear. Recent evidence that glucose carriers can conduct water raised the possibility that the glucose carrier, which is abundant in human erythrocytes, is the water channel. To test this possibility, water permeabilities and glucose fluxes were measured in large unilamellar vesicles (LUV) containing human erythrocyte lipid alone (lipid LUV), reconstituted purified human erythrocyte glucose carrier (Glut1 LUV), or reconstituted glucose carrier in the presence of other human erythrocyte ghost proteins (ghost LUV). In glucose and ghost LUV, glucose carriers were present at 25% of the density of native erythrocytes, were oriented randomly in the bilayer, and exhibited characteristic inhibition of glucose flux when exposed to cytochalasin B. Osmotic water permeability (P(f), in centimeters per second; n = 4) averaged 0.0012 ± 0.00033 in lipid LUV, 0.0032 ± 0.0015 in Glut1 LUV, and 0.006 ± 0.0014 in ghost LUV. Activation energies of water flow for the three preparations ranged between 10 and 13 kcal/mol; p-(chloromercuri)benzenesulfonate (pCMBS), an organic mercurial inhibitor of erythrocyte water channels, and cytochalasin B did not alter P(f). These results indicate that reconstitution of glucose carriers at high density increases water permeability but does not result in **water channel activity**. However, because the turnover number of reconstituted carriers is reduced from that of native carriers, experiments were also performed on erythrocyte ghosts with intact water channel function. In ghosts, P(f) averaged 0.038 ± 0.013 (n = 9), while the activation energy for water flow averaged 3.0 ± 0.3 kcal/mol. Mercuric chloride reduced P(f) by 93%, while pCMBS reduced it by 69%. Thus, ghosts retained water channel function. Preparation of ghosts in the presence of calcium led to markedly reduced glucose carrier activity without altering P(f). In addition, cytochalasin B did not reduce P(f). We conclude that the erythrocyte glucose carrier is not the water channel. The identity of the erythrocyte water channel remains elusive.

ACCESSION NUMBER: 92087462 EMBASE
DOCUMENT NUMBER: 1992087462
TITLE: Role of glucose carrier in human erythrocyte water permeability.
AUTHOR: Zeidel M.L.; Albalak A.; Grossman E.; Carruthers A.
CORPORATE SOURCE: Research Service, West Roxbury VA Medical Center, 1400 V.F.W. Parkway,West Roxbury, MA 02132, United States
SOURCE: Biochemistry, (1992) 31/2 (589-596).
ISSN: 0006-2960 CODEN: BICHAW
COUNTRY: United States
DOCUMENT TYPE: Journal; Article
FILE SEGMENT: 029 Clinical Biochemistry
LANGUAGE: English
SUMMARY LANGUAGE: English

L1 ANSWER 52 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Interactions between plasma membrane aquaporins modulate their **water channel activity**.
AB Plant plasma membrane intrinsic proteins (PIPs) cluster in two evolutionary subgroups, PIP1 and PIP2, with different aquaporin activities when expressed in Xenopus oocytes. Maize ZmPIP1;1 and ZmPIP1;2 do not increase the osmotic water permeability coefficient (Pf), whereas ZmPIP2;1, ZmPIP2;4, and ZmPIP2;5 do. Here, we show that coexpression of the nonfunctional ZmPIP1;2 and the functional ZmPIP2;1, ZmPIP2;4, or ZmPIP2;5 resulted in an increase in Pf that was dependent on the amount of injected ZmPIP1;2 complementary RNA. Confocal analysis of oocytes expressing ZmPIP1;2-green fluorescent **protein** (GFP) alone or ZmPIP1;2-GFP plus ZmPIP2;5 showed that the amount of ZmPIP1;2-GFP present in the plasma membrane was significantly greater in coexpressing cells. Nickel affinity chromatography purification of ZmPIP2;1 fused to a His tag coeluted with ZmPIP1;2-GFP demonstrated physical interaction and heteromerization of both isoforms. Interestingly, coexpression of ZmPIP1;1 and ZmPIP2;5 did not result in a greater increase in Pf than did the expression of ZmPIP2;5 alone, but coexpression of the ZmPIP1;1 and

ZmPIP1;2 isoforms induced a Pf increase, indicating that PIP1 isoform heteromerization is required for both of them to act as functional water channels. Mutational analysis demonstrated the important role of the C-terminal part of loop E in PIP interaction and **water channel activity** induction. This study has revealed a new mechanism of plant aquaporin regulation that might be important in plant water relations.

ACCESSION NUMBER: 2004:94961 BIOSIS
DOCUMENT NUMBER: PREV200400084066
TITLE: Interactions between plasma membrane aquaporins modulate their **water channel activity**.
AUTHOR(S): Fetter, Karolina; Van Wilder, Valerie; Moshelion, Menachem; Chaumont, Francois [Reprint Author]
CORPORATE SOURCE: Unite de Biochimie Physiologique, Institut des Science de la Vie, Universite Catholique de Louvain, Croix du Sud 2-20, B-1348, Louvain-la-Neuve, Belgium
chaumont@fysa.ucl.ac.be
SOURCE: Plant Cell, (January 2004) Vol. 16, No. 1, pp. 215-228. print.
CODEN: PLCEEW. ISSN: 1040-4651.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 11 Feb 2004
Last Updated on STN: 11 Feb 2004

L1 ANSWER 53 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Plasma membrane aquaporins are involved in winter embolism recovery in walnut tree.
AB In perennial plants, freeze-thaw cycles during the winter months can induce the formation of air bubbles in xylem vessels, leading to changes in their hydraulic conductivity. Refilling of embolized xylem vessels requires an osmotic force that is created by the accumulation of soluble sugars in the vessels. Low water potential leads to water movement from the parenchyma cells into the xylem vessels. The water flux gives rise to a positive pressure essential for the recovery of xylem hydraulic conductivity. We investigated the possible role of plasma membrane aquaporins in winter embolism recovery in walnut (Juglans regia). First, we established that xylem parenchyma starch is converted to sucrose in the winter months. Then, from a xylem-derived cDNA library, we isolated two PIP2 aquaporin genes (JrPIP2,1 and JrPIP2,2) that encode nearly identical proteins. The **water channel activity** of the JrPIP2,1 **protein** was demonstrated by its expression in Xenopus laevis oocytes. The expression of the two PIP2 isoforms was investigated throughout the autumn-winter period. In the winter period, high levels of PIP2 mRNA and corresponding **protein** occurred simultaneously with the rise in sucrose. Furthermore, immunolocalization studies in the winter period show that PIP2 aquaporins were mainly localized in vessel-associated cells, which play a major role in controlling solute flux between parenchyma cells and xylem vessels. Taken together, our data suggest that PIP2 aquaporins could play a role in water transport between xylem parenchyma cells and embolized vessels.

ACCESSION NUMBER: 2003:577896 BIOSIS
DOCUMENT NUMBER: PREV200300583620
TITLE: Plasma membrane aquaporins are involved in winter embolism recovery in walnut tree.
AUTHOR(S): Sakr, Soulaiman [Reprint Author]; Alves, Georges; Morillon, Raphael; Maurel, Karine; Decourteix, Melanie; Guilliot, Agnes; Fleurat-Lessard, Pierrette; Julien, Jean-Louis; Chrispeels, Maarten J.
CORPORATE SOURCE: Physiologie Integree de d'Arbre Fruitier, Unite Mixte de Recherche 547, Institut National de la Recherche Agronomique, Universite Blaise Pascal, 24 Avenue des Landais, Site des Cezeaux, 63177, Aubiere Cedex, France
Soulaiman.Sakr@piaf.univ-bpclermont.fr

SOURCE: Plant Physiology (Rockville), (October 2003) Vol. 133, No. 2, pp. 630-641. print.
ISSN: 0032-0889 (ISSN print).
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 10 Dec 2003
Last Updated on STN: 10 Dec 2003

L1 ANSWER 54 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Characterization of two tomato aquaporins and expression during the incompatible interaction of tomato with the plant parasite Cuscuta reflexa.
AB A subtractive suppression hybridization technique was used to identify genes that were induced during early phases of the interaction between Cuscuta reflexa, a phanerogamic plant parasite and the incompatible host tomato (Lycopersicon esculentum Mill.). One of the identified genes encodes a new aquaporin (LeAqp2) from tomato. Its function was concluded from the swelling kinetics of LeAqp2-expressing Xenopus laevis oocytes under hypo-osmotic conditions. It was shown that, 6 h after attachment of the plant parasite, the corresponding mRNA accumulated in cells at and adjacent to the attachment site of Cuscuta, while artificial wounding did not modify steady-state LeAqp2-RNA levels. Expression of a close homologue named TRAMP (tomato-ripening-associated **protein**) was not affected by the plant-plant interaction. Levels of indole-3-acetic acid (IAA) in tomato tissue after infection by Cuscuta have been found to increase at a similar stage of infection. In contrast to the different behavior with respect to infection, IAA induced both LeAqp2 and TRAMP expression. The observed pattern of LeAqp2 expression during the interaction at a stage where cell elongation occurs together with the **water-channel activity** in the heterologous expression system suggest a function for LeAqp2 during the tomato-Cuscuta interaction.
ACCESSION NUMBER: 2003:418154 BIOSIS
DOCUMENT NUMBER: PREV200300418154
TITLE: Characterization of two tomato aquaporins and expression during the incompatible interaction of tomato with the plant parasite Cuscuta reflexa.
AUTHOR(S): Werner, Monika; Uehlein, Norbert; Proksch, Peter; Kaldenhoff, Ralf [Reprint Author]
CORPORATE SOURCE: Molekulare Pflanzenphysiologie und Biophysik, Universitaet Wuerzburg, Julius-von-Sachs-Institut fuer Biowissenschaften, Julius-von-Sachs-Platz 2, 97082, Wuerzburg, Germany
kaldenhoff@botanik.uni-wuerzburg.de
SOURCE: Planta (Berlin), (August 2001) Vol. 213, No. 4, pp. 550-555. print.
CODEN: PLANAB. ISSN: 0032-0935.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 10 Sep 2003
Last Updated on STN: 10 Sep 2003

L1 ANSWER 55 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI The Effects of Posttranslational Modifications on the **Water Channel Activity** of Human Aquaporin 0.
AB Purpose: The goal of the present study is to assess the effect of prevalent C-terminal posttranslational modifications of aquaporin 0 (AQP0), observed in normal aging and cataractous human lenses, on the water permeability of AQP0 and potential regulation of AQP0 **water channel activity**. Methods: The water permeabilities of human wild type and mutant AQP0's, 1-234, 1-238, 1-243, S235A, were measured in a Xenopus laevis oocyte swelling assay. A direct comparison of wild type and mutant AQP permeability was permitted by the development of a new extracellular binding assay to quantitate the level of AQP0

protein membrane expression. The effects of kinase stimulation on the permeability were examined following treatment of oocytes with PMA or forskolin. Results: A dose dependent increase in water permeability and extracellular binding was observed in Xenopus oocytes injected with increasing amounts of wt, 1-243, and S235A AQP0 mRNA. Truncation of AQP0 at residue 243 resulted in a lower water permeability than that observed for the wild type **protein** (5.2 x10-3 and 6.6 x10-3 cm/sec). However, after normalizing for membrane expression, the permeability per molecule for the truncated **protein**, 1-243, was the same as for wild type AQP0. Further truncation of AQP0 at residues 234 and 238 prevented the incorporation of 1-234 and 1-238 into the oocyte plasma membrane. Activation of PKC by 100nM PMA resulted in a 10-25% decrease in the permeability of oocytes injected with wild type or S235A AQP0 mRNA. Conclusion: Truncation of the C-terminal residues 244-263 from AQP0, a major modification in aged human lenses, does not alter the **water channel activity** of AQP0. The lack of membrane incorporation of truncated AQPs, 1-234 and 1-238, precluded the measurement of channel activity and indicates that the C-terminus of AQP0 is necessary for **protein** trafficking. Phosphorylation may play a role in regulation of channel activity indirectly or through a site other than S235 as suggested by the decrease in the permeability of oocytes expressing wild type and S235A AQP0 after PKC stimulation.

ACCESSION NUMBER: 2003:165723 BIOSIS
DOCUMENT NUMBER: PREV200300165723
TITLE: The Effects of Posttranslational Modifications on the **Water Channel Activity** of Human Aquaporin 0.
AUTHOR(S): Ball, L. E. [Reprint Author]; Nowak, M. W. [Reprint Author]; Crouch, R. K.; Schey, K. L. [Reprint Author]
CORPORATE SOURCE: Department of Pharmacology, Medical University of South Carolina, Charleston, SC, USA
SOURCE: ARVO Annual Meeting Abstract Search and Program Planner, (2002) Vol. 2002, pp. Abstract No. 4640. cd-rom. Meeting Info.: Annual Meeting of the Association For Research in Vision and Ophthalmology. Fort Lauderdale, Florida, USA. May 05-10, 2002.
DOCUMENT TYPE: Conference; (Meeting)
Conference; Abstract; (Meeting Abstract)
LANGUAGE: English
ENTRY DATE: Entered STN: 2 Apr 2003
Last Updated on STN: 2 Apr 2003

L1 ANSWER 56 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.
AB The aquaporin PM28A is one of the major integral proteins in spinach leaf plasma membranes. Phosphorylation/dephosphorylation of Ser274 at the C-terminus and of Ser115 in the first cytoplasmic loop has been shown to regulate the **water channel activity** of PM28A when expressed in Xenopus oocytes. To understand the mechanisms of the phosphorylation-mediated gating of the channel the structure of PM28A is required. In a first step we have used the methylotrophic yeast Pichia pastoris for expression of the pm28a gene. The expressed **protein** has a molecular mass of 32462 Da as determined by matrix-assisted laser desorption ionization-mass spectrometry, forms tetramers as revealed by electron microscopy and is functionally active when reconstituted in proteoliposomes. PM28A was efficiently solubilized from urea- and alkali-stripped Pichia membranes by octyl-beta-D-thioglucopyranoside resulting in a final yield of 25 mg of purified **protein** per liter of cell culture.

ACCESSION NUMBER: 2003:153581 BIOSIS
DOCUMENT NUMBER: PREV200300153581
TITLE: Reconstitution of water channel function of an aquaporin overexpressed and purified from Pichia pastoris.

AUTHOR(S): Karlsson, Maria; Fotiadis, Dimitrios; Sjovall, Sara; Johansson, Ingela; Hedfalk, Kristina; Engel, Andreas; Kjellbom, Per [Reprint Author]
CORPORATE SOURCE: Department of Plant Biochemistry, Lund University, S-22100, Box 124, Lund, Sweden
maria.karlsson@plantbio.lu.se; dimitrios.fotiadis@unibas.ch; sara.sjovall@plantbio.lu.se; i.johansson@bio.gla.ac.uk; kristina.hedfalk@gmm.gu.se; andreas.engel@unibas.ch; per.kjellbom@plantbio.lu.se
SOURCE: FEBS Letters, (27 February 2003) Vol. 537, No. 1-3, pp. 68-72. print.
CODEN: FEBLAL. ISSN: 0014-5793.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 26 Mar 2003
Last Updated on STN: 9 May 2003

L1 ANSWER 57 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI 2,3-Butanedione monoxime (BDM), a potent inhibitor of actin-myosin interaction, induces ion and fluid transport in MDCK monolayers.
AB Membrane-cytoskeleton interactions have been shown to be crucial to modulate polarity, cell shape and the paracellular pathway in epithelial MDCK cell monolayers. In particular, actin organization and myosin-dependent contractility play an important role in the regulation of these functions. Participation of myosin in vectorial transport, expressed as formation of domes, was investigated in confluent monolayers of high transepithelial electrical resistance (TER) plated on non-permeable supports. Cells exposed to 2,3-butanedione monoxime, a selective inhibitor of myosin ATPase, showed a remarkable increase in the number of domes. Replacement of extracellular Na+ and Cl- and inhibition of Na+-K+-ATPase blocked the induction of domes. The monoxime also caused a reduction of the TER leading to an increase in the paracellular flux of small molecular weight dextran. However, immunofluorescence microscopy of drug-treated cells showed that the localization and staining pattern of tight junction proteins ZO-1, occludin, and claudin 1, or the actin-myosin ring at the zonula adherens, were not modified. Treatment with the drug produced striking re-arrangements of actin filaments at the microvilli and at the basal level of the cells. Our data show that disruption of actin-myosin interaction at several cellular sites contributed importantly to the increased transport activity and the formation of the domes. These results point to the relevant role for actin-myosin dynamics and actin organization in the regulation of ion and **water channel activity** in these cells.
ACCESSION NUMBER: 2003:60016 BIOSIS
DOCUMENT NUMBER: PREV200300060016
TITLE: 2,3-Butanedione monoxime (BDM), a potent inhibitor of actin-myosin interaction, induces ion and fluid transport in MDCK monolayers.
AUTHOR(S): Castillo, Aida M.; Reyes, Jose Luis; Sanchez, Elsa; Mondragon, Ricardo; Meza, Isaura [Reprint Author]
CORPORATE SOURCE: Department of Biomedicina Molecular, Centro de Investigacion y de Estudios Avanzados del IPN, Apartado 14-740, Mexico, DF, 07000, Mexico
imeza@mail.cinve-stav.mx
SOURCE: Journal of Muscle Research and Cell Motility, (2002) Vol. 23, No. 3, pp. 223-234. print.
CODEN: JMRMD3. ISSN: 0142-4319.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 22 Jan 2003
Last Updated on STN: 22 Jan 2003

L1 ANSWER 58 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Plant aquaporins: Multifunctional water and solute channels with expanding

roles.

AB There is strong evidence that aquaporins are central components in plant water relations. Plant species possess more aquaporin genes than species from other kingdoms. According to sequence similarities, four major groups have been identified, which can be further divided into subgroups that may correspond to localization and transport selectivity. They may be involved in compatible solute distribution, gas-transfer (CO2, NH3) as well as in micronutrient uptake (boric acid). Recent advances in determining the structure of some aquaporins gives further details on the mechanism of selectivity. Gating behaviour of aquaporins is poorly understood but evidence is mounting that phosphorylation, pH, pCa and osmotic gradients can affect **water channel activity**. Aquaporins are enriched in zones of fast cell division and expansion, or in areas where water flow or solute flux density would be expected to be high. This includes biotrophic interfaces between plants and parasites, between plants and symbiotic bacteria or fungi, and between germinating pollen and stigma. On a cellular level aquaporin clusters have been identified in some membranes. There is also a possibility that aquaporins in the endoplasmic reticulum may function in symplasmic transport if water can flow from cell to cell via the desmotubules in plasmodesmata. Functional characterization of aquaporins in the native membrane has raised doubt about the conclusiveness of expression patterns alone and need to be conducted in parallel. The challenge will be to elucidate gating on a molecular level and cellular level and to tie those findings into plant water relations on a macroscopic scale where various flow pathways need to be considered.

ACCESSION NUMBER: 2002:204445 BIOSIS
DOCUMENT NUMBER: PREV200200204445
TITLE: Plant aquaporins: Multifunctional water and solute channels with expanding roles.
AUTHOR(S): Tyerman, S. D. [Reprint author]; Niemietz, C. M.; Bramley, H.
CORPORATE SOURCE: Department of Horticulture Viticulture and Oenology, Plant Research Centre, Adelaide University, Waite Campus, Glen Osmond, SA, 5064, Australia
steve.tyerman@adelaide.edu.au
SOURCE: Plant Cell and Environment, (February, 2002) Vol. 25, No. 2, pp. 173-194. print.
CODEN: PLCEDV. ISSN: 0140-7791.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 20 Mar 2002
Last Updated on STN: 20 Mar 2002

L1 ANSWER 59 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN

TI Highly selective **water channel activity** measured by voltage clamp: Analysis of planar lipid bilayers reconstituted with purified AqpZ.

AB Aquaporins are membrane channels selectively permeated by water or water plus glycerol. Conflicting reports have described ion conductance associated with some water channels, raising the question of whether ion conductance is a general property of the aquaporin family. To clarify this question, a defined system was developed to simultaneously measure water permeability and ion conductance. The Escherichia coli water channel aquaporin-Z (AqpZ) was studied, because it is a highly stable tetramer. Planar lipid bilayers were formed from unilamellar vesicles containing purified AqpZ. The hydraulic conductivity of bilayers made from the total extract of E. coli lipids increased 3-fold if reconstituted with AqpZ, but electric conductance was unchanged. No channel activity was detected under voltage-clamp conditions, indicating that less than one in 109 transport events is electrogenic. Microelectrode measurements were simultaneously undertaken adjacent to the membrane. Changes in sodium concentration profiles accompanying transmembrane water flow permitted calculation of the activation energies: 14 kcal/mol for **protein**

-free lipid bilayers and 4 kcal/mol for lipid bilayers containing AqpZ. Neither the water permeability nor the electric conductivity exhibited voltage dependence. This sensitive system demonstrated that AqpZ is permeated by water but not charged ions and should permit direct analyses of putative electrogenic properties of other aquaporins.

ACCESSION NUMBER: 2001:427315 BIOSIS
DOCUMENT NUMBER: PREV200100427315
TITLE: Highly selective **water channel activity** measured by voltage clamp: Analysis of planar lipid bilayers reconstituted with purified AqpZ.
AUTHOR(S): Pohl, Peter [Reprint author]; Saparov, Sapar M.; Borgnia, Mario J.; Agre, Peter
CORPORATE SOURCE: Nachwuchsgruppe Biophysik, Forschungsinstitut fuer Molekulare Pharmakologie, Robert-Roessle-Strasse 10, 13125, Berlin, Germany
pohl@fmp-berlin.de; pagre@jhmi.edu
SOURCE: Proceedings of the National Academy of Sciences of the United States of America, (August 14, 2001) Vol. 98, No. 17, pp. 9624-9629. print.
CODEN: PNASA6. ISSN: 0027-8424.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 12 Sep 2001
Last Updated on STN: 22 Feb 2002

L1 ANSWER 60 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI The **water channel activity** of modified human MIP.

ACCESSION NUMBER: 2001:310570 BIOSIS
DOCUMENT NUMBER: PREV200100310570
TITLE: The **water channel activity** of modified human MIP.
AUTHOR(S): Ball, L. E. [Reprint author]; Nowak, M. W. [Reprint author]; Crouch, R. K.; Schey, K. L. [Reprint author]
CORPORATE SOURCE: Department of Pharmacology, Medical University of South Carolina, Charleston, SC, USA
SOURCE: IOVS, (March 15, 2001) Vol. 42, No. 4, pp. S875. print.
Meeting Info.: Annual Meeting of the Association for Research in Vision and Ophthalmology. Fort Lauderdale, Florida, USA. April 29-May 04, 2001.
DOCUMENT TYPE: Conference; (Meeting)
Conference; Abstract; (Meeting Abstract)
LANGUAGE: English
ENTRY DATE: Entered STN: 27 Jun 2001
Last Updated on STN: 19 Feb 2002

L1 ANSWER 61 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Existence of a tightly regulated water channel in Saccharomyces cerevisiae.
AB The Saccharomyces cerevisiae strain sum1278b possesses two putative aquaporins, Aqy1-1p and Aqy2-1p. Previous work demonstrated that Aqy1-1p functions as a water channel in Xenopus oocyte. However, no function could be attributed to Aqy2-1p in this system. Specific antibodies were used to follow the expression of Aqy1-1p and Aqy2-1p in the yeast. Aqy1-1p was never detected whatever the growth phase and culture conditions tested. In contrast, Aqy2-1p was detected only during the exponential growth phase in rich medium containing glucose. Aqy2-1p expression was repressed by hyper-osmotic culture conditions. Both immunocytochemistry and biochemical subcellular fractionation demonstrated that Aqy2-1p is located on the endoplasmic reticulum (ER) as well as on the plasma membrane. In microsomal vesicles enriched in ER, a **water channel activity** due to Aqy2-1p was detected by stopped-flow analysis. Our results show that the expression of aquaporins is tightly controlled. The physiological relevance of

aquaporin-mediated water transport in yeast is discussed.
ACCESSION NUMBER: 2001:173667 BIOSIS
DOCUMENT NUMBER: PREV200100173667
TITLE: Existence of a tightly regulated water channel in Saccharomyces cerevisiae.
AUTHOR(S): Meyrial, Valerie; Laize, Vincent; Gobin, Renee; Ripoche, Pierre; Hohmann, Stefan; Tacnet, Frederique [Reprint author]
CORPORATE SOURCE: Departement de Biologie Cellulaire et Moleculaire, SBCe, CEA/Saclay, Gif sur Yvette cedex, F-91191, France tacnet@dsvidf.cea.fr
SOURCE: European Journal of Biochemistry, (Janaury, 2001) Vol. 268, No. 2, pp. 334-343. print.
CODEN: EJBCAI. ISSN: 0014-2956.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 11 Apr 2001
Last Updated on STN: 18 Feb 2002

L1 ANSWER 62 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.
AB Opacities in the crystalline lens of eye appear with high frequency in the general population. Dominantly inherited cataracts with differing clinical features were found in two families carrying different point mutations in the gene encoding lens water channel **protein** AQP0 (major intrinsic **protein**, MIP). Families with E134G have a uni-lamellar cataract which is stable after birth, whereas families with T138R have multi-focal opacities which increase throughout life. To establish pathophysiological relevance of cataract formation, the Xenopus laevis oocyte expression system was employed to evaluate functional defects in the mutant proteins, E134G and T138R. Both substitutions cause loss of membrane **water channel activity** due to impaired trafficking of the mutant proteins to the oocyte plasma membrane. Although missense mutations in AQP1 and AQP2 proteins are known to result in recessive traits in vivo and in vitro, when E134G or T138R are co-expressed with wild-type AQP0 **protein**, the mutant proteins exhibit dominant negative behaviour. To our knowledge, these studies represent the first in vitro demonstration of functionally defective AQP0 **protein** from humans with congenital cataracts. Moreover, these observations predict that less severe defects in the AQP0 **protein** may contribute to lens opacity in patients with common, less fulminant forms of cataracts.
ACCESSION NUMBER: 2000:466928 BIOSIS
DOCUMENT NUMBER: PREV200000466928
TITLE: Functional impairment of lens aquaporin in two families with dominantly inherited cataracts.
AUTHOR(S): Francis, Peter; Chung, Jean-Ju; Yasui, Masato; Berry, Vanita; Moore, Anthony; Wyatt, M. Keith; Wistow, Graeme; Bhattacharya, Shomi S.; Agre, Peter [Reprint author]
CORPORATE SOURCE: Department of Biological Chemistry, Johns Hopkins University School of Medicine, 75 North Wolfe Street, Baltimore, MD, 21205-2185, USA
SOURCE: Human Molecular Genetics, (22 September, 2000) Vol. 9, No. 15, pp. 2329-2334. print.
ISSN: 0964-6906.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 1 Nov 2000
Last Updated on STN: 10 Jan 2002

L1 ANSWER 63 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Regulation of **water channel activity** in whole roots and in protoplasts from roots of melon plants grown under

saline conditions.

AB Measurements of the hydraulic conductance (L0) of roots of melon plants (Cucumis melo L.) derived from roots grown under saline conditions were performed to determine the effect of NaCl and which ion, Na+ or Cl-, is involved. Root hydraulic conductance of plants treated with a 50 mM NaCl, 47 mM Na+ or 45 mM Cl- salts mixture was reduced, but the reduction was less when 10 mM CaCl2 was added before the salts, except in the case of the Cl- salt mixture. Only when CaCl2 was applied before NaCl was there an ameliorative effect on L0 (25.8% increase). Addition of HgCl2 reduced the L0 of control plants, but the reduction progressively decreased as the NaCl concentration was increased (from 0 to 50 mM). Osmotic water permeability (Pf) values were calculated in root protoplasts treated with 90 mM NaCl. Large reductions were observed with the NaCl treatment (10.38 mum s-1 for the control and 3.31 mum s-1 for the NaCl treatment). In addition, Pf measurements were carried out for protoplasts treated with 100 mM NaCl plus the phosphatase inhibitor, okadaic acid (5 muM). The effect of okadaic acid on Pf values before and after NaCl addition was similar (6.61 and 7.01 mum s-1, respectively), showing a smaller decrease of Pf than with NaCl alone with respect to control protoplasts. The results showed that the negative effect of NaCl on **water channel activity** was not due to a high ion concentration effect on channel pores or to the increase in osmotic pressure. We suggest that it was due to a direct action of NaCl on **protein** regulation.

ACCESSION NUMBER: 2000:388852 BIOSIS
DOCUMENT NUMBER: PREV200000388852
TITLE: Regulation of **water channel activity** in whole roots and in protoplasts from roots of melon plants grown under saline conditions.
AUTHOR(S): del Carmen Martinez-Ballesta, Maria; Martinez, Vicente; Carvajal, Micaela [Reprint author]
CORPORATE SOURCE: Dpto. Nutricion y Fisiologia Vegetal, Centro de Edafologia y Biologia Aplicada del Segura, CSIC, 30080, Murcia, Spain
SOURCE: Australian Journal of Plant Physiology, (2000) Vol. 27, No. 7, pp. 685-691. print.
CODEN: AJPPCH. ISSN: 0310-7841.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 13 Sep 2000
Last Updated on STN: 8 Jan 2002

L1 ANSWER 64 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN

TI **Protein** kinase A-dependent phosphorylation of aquaporin-1.

AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. Previous results from our laboratory demonstrated that **water channel activity** of AQP1 was significantly increased by **protein** kinase A (PKA) activators such as cyclic-AMP (cAMP) and forskolin. The purpose of this study is to determine whether PKA-dependent **protein** phosphorylation is involved in the regulation of **water channel activity** of AQP1. Results presented here suggest that catalytic subunit of **protein** kinase A significantly increased the amount of phosphorylated AQP1 **protein**. In addition, these results indicated that cAMP-responsive redistribution of AQP1 may be regulated by phosphorylation of AQP1. Moreover, they provide new insights on the molecular mechanisms for regulating water balance in several tissues involving rapid water transport such as ciliary epithelium. In addition, they suggest important potential roles for AQP1 in several clinical disorders involving rapid water transport such as glaucoma.

ACCESSION NUMBER: 2000:345366 BIOSIS
DOCUMENT NUMBER: PREV200000345366

TITLE: **Protein** kinase A-dependent phosphorylation of aquaporin-1.
AUTHOR(S): Han, Zhiqiang; Patil, Rajkumar V. [Reprint author]
CORPORATE SOURCE: Department of Ophthalmology and Visual Sciences, Washington University School of Medicine, 660 South Euclid, Saint Louis, MO, 63110, USA
SOURCE: Biochemical and Biophysical Research Communications, (June 24, 2000) Vol. 273, No. 1, pp. 328-332. print.
CODEN: BBRCA9. ISSN: 0006-291X.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 16 Aug 2000
Last Updated on STN: 7 Jan 2002

L1 ANSWER 65 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI The **water channel activity** of human MIP.
ACCESSION NUMBER: 2000:263443 BIOSIS
DOCUMENT NUMBER: PREV200000263443
TITLE: The **water channel activity** of human MIP.
AUTHOR(S): Ball, L. E. [Reprint author]; Nowak, M. W.; Grouch, R. K.; Schey, K. L.
CORPORATE SOURCE: Department of Pharmacology, Medical University of South Carolina, Charleston, SC, USA
SOURCE: IOVS, (March 15, 2000) Vol. 41, No. 4, pp. S863. print.
Meeting Info.: Annual Meeting of the Association in Vision and Opthalmology. Fort Lauderlade, Florida, USA. April 30-May 05, 2000. Association for Research in Vision and Ophthalmology.
DOCUMENT TYPE: Conference; (Meeting)
Conference; Abstract; (Meeting Abstract)
Conference; (Meeting Poster)
LANGUAGE: English
ENTRY DATE: Entered STN: 21 Jun 2000
Last Updated on STN: 5 Jan 2002

L1 ANSWER 66 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
AB The water channel **protein** alpha-TIP is a member of the major intrinsic **protein** (MIP) membrane channel family. This aquaporin is found abundantly in vacuolar membranes of cotyledons (seed storage organs) and is synthesized during seed maturation. The **water channel activity** of alpha-TIP can be regulated by phosphorylation, and the **protein** may function in seed desiccation, cytoplasmic osmoregulation, and/or seed rehydration. alpha-TIP was purified from seed meal of the common bean (Phaseolus vulgaris) by membrane fractionation, solubilization in diheptanoylphosphocholine and anion-exchange chromatography. Upon detergent removal and reconstitution into lipid bilayers, alpha-TIP crystallized as helical tubes. Electron cryo-crystallography of flattened tubes demonstrated that the crystals exhibit plane group p2 symmetry and c222 pseudosymmetry. Since the 2D crystals with p2 symmetry are derived from helical tubes, we infer that the unit of crystallization on the helical lattice is a dimer of tetramers. A projection density map at a resolution of 7.7 ANG revealed that alpha-TIP assembles as a 60 ANG X 60 ANG square tetramer. Each subunit is formed by a heart-shaped ring comprised of density peaks which we interpret as alpha-helices. The similarity of this structure to mammalian plasma membrane MIP-family proteins suggests that the molecular design of functionally analogous and genetically homologous aquaporins is maintained between the plant and animal kingdoms.
ACCESSION NUMBER: 2000:85217 BIOSIS
DOCUMENT NUMBER: PREV200000085217

TITLE: Projection structure of a plant vacuole membrane aquaporin by electron cryo-crystallography.
AUTHOR(S): Daniels, Mark J.; Chrispeels, Maarten J.; Yeager, Mark [Reprint author]
CORPORATE SOURCE: Department of Cell Biology, Scripps Research Institute, 10550 North Torrey Pines Road, La Jolla, CA, 92037, USA
SOURCE: Journal of Molecular Biology, (Dec. 17, 1999) Vol. 294, No. 5, pp. 1337-1349. print.
CODEN: JMOBAK. ISSN: 0022-2836.
DOCUMENT TYPE: Article
LANGUAGE: English
OTHER SOURCE: Genbank-A41616; Genbank-CAA44669; Genbank-CAA65799; Genbank-P06624; Genbank-U38664
ENTRY DATE: Entered STN: 1 Mar 2000
Last Updated on STN: 3 Jan 2002

L1 ANSWER 67 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Transmembrane helix 5 is critical for the high water permeability of aquaporin.
AB Aquaporin-2 (AQP2), a vasopressin-regulated water channel, plays a major role in urinary concentration. AQP2 and the major intrinsic **protein** (MIP) of lens fiber are highly homologous (58% amino acid identity) and share a topology of six transmembrane helices connected by five loops (loops A-E). Despite the similarities of these proteins, however, the **water channel activity** of AQP2 is much higher than that of MIP. To determine the site responsible for this gain of activity in AQP2, several parts of MIP were replaced with the corresponding parts of AQP2. When expressed in Xenopus oocytes, the osmotic water permeability (Pf) of MIP and AQP2 was 48 and 245 X 10-4 cm/s, respectively. Substitutions in loops B-D failed to increase Pf, whereas substitution of loop E significantly increased Pf 1.5-fold. A similar increase in Pf was observed with the substitution of the front half of loop E. Pf measurements taken in a yeast vesicle expression system also confirmed that loop E had a complementary effect, whereas loops B-D did not. However, Pf values of the loop E chimeras were only apprx30% of that of AQP2. Simultaneous exchanges of loop E and a distal half of transmembrane helix 5 just proximal to loop E increased Pf to the level of that of AQP2. Replacement of helix 5 alone stimulated Pf 2.7-fold. Conversely, Pf was decreased by 73% when helix 5 of AQP2 was replaced with that of MIP. Moreover, Pf was stimulated 2.6- and 3.3-fold after helix 5 of AQP1 and AQP4 was spliced into MIP, respectively. Our findings suggested that the distal half of helix 5 is necessary for maximum **water channel activity** in AQP. We speculate that this portion contributes to the formation of the aqueous pore and the determination of the flux rate.
ACCESSION NUMBER: 2000:49850 BIOSIS
DOCUMENT NUMBER: PREV200000049850
TITLE: Transmembrane helix 5 is critical for the high water permeability of aquaporin.
AUTHOR(S): Kuwahara, Michio [Reprint author]; Shinbo, Itsuki; Sato, Kazunori; Terada, Yoshio; Marumo, Fumiaki; Sasaki, Sei
CORPORATE SOURCE: Second Department of Internal Medicine, School of Medicine, Tokyo Medical and Dental University, Tokyo, 113-8519, Japan
SOURCE: Biochemistry, (Dec. 7, 1999) Vol. 38, No. 49, pp. 16340-16346. print.
CODEN: BICHAW. ISSN: 0006-2960.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 3 Feb 2000
Last Updated on STN: 31 Dec 2001

L1 ANSWER 68 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI CHIPs and TIPs: A review on water channel.
AB Water channels are intrinsic proteins of the tonoplast or plasma membrane

and supposedly regulate symplastic water transport. They are gated, thereby providing a water transport facility through the plasma membrane following an osmotic gradient. Water channels are highly selective for water molecules and enable rapid and effective regulation of symplastic water transport in plants. This regulation is by a sensitive closing mechanism, induced by **protein** phosphorylation, in the short and by distribution and frequency, disintegration and de novo synthesis of water channel **protein** in the long term. These joint mechanisms are designated as **water channel activity**.
The estimated half-life is several hours. The present review summarises present knowledge on their structure, function, and regulatory mechanisms as well as their potential role in horticultural science.

ACCESSION NUMBER: 1998:486263 BIOSIS
DOCUMENT NUMBER: PREV199800486263
TITLE: CHIPs and TIPs: A review on water channel.
AUTHOR(S): Blanke, M. [Reprint author]
CORPORATE SOURCE: Inst. Obstbau Gemuesebau, Univ. Bonn, Auf dem Huegel 6, 53121 Bonn, Germany
SOURCE: Gartenbauwissenschaft, (May-June, 1998) Vol. 63, No. 3, pp. 133-137. print.
CODEN: GTBWAY. ISSN: 0016-478X.
DOCUMENT TYPE: Article
LANGUAGE: German
ENTRY DATE: Entered STN: 5 Nov 1998
Last Updated on STN: 5 Nov 1998

L1 ANSWER 69 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Molecular cloning, **water channel activity** and tissue specific expression of two isoforms of radish vacuolar aquaporin.
AB A major membrane intrinsic **protein** (VM23) in vacuoles of radish (Raphanus) tap root was investigated. The cDNAs for two isoforms of VM23, gamma- and delta-VM23, encode polypeptides of 253 and 248 amino acids, respectively.),and delta-VM23 correspond to the gamma- and delta-TIP (tonoplast intrinsic **protein**) of Arabidopsis. The deduced amino acid sequences of the two VM23 isoforms were 60% identical. The amino-terminal sequence of gamma-VM23 showed agreement with the direct sequence of the purified VM23, suggesting that gamma-VM23 is the most abundant molecule among the VM23 isoforms. When mRNAs of gamma- and delta-VM23 were injected into Xenopus oocytes, the osmotic water permeability of oocytes increased 6-fold (60 to 200 mum s-1) of the control oocytes. The transcripts of both isoforms were detected in a high level in growing hypocotyls and young leaves, but delta-VM23 was not detected in seedling roots. Light illumination enhanced the transcription of two genes of VM23 in cotyledons and roots but suppressed their expression in hypocotyls the growth of which was inhibited by light. These findings suggest that the expression of VM23 is tightly related to cell elongation.

ACCESSION NUMBER: 1998:486255 BIOSIS
DOCUMENT NUMBER: PREV199800486255
TITLE: Molecular cloning, **water channel activity** and tissue specific expression of two isoforms of radish vacuolar aquaporin.
AUTHOR(S): Higuchi, Tatsuji; Suga, Shinobu; Tsuchiya, Tomohiro; Hisada, Hiromoto; Morishima, Shigeru; Okada, Yasunobu; Maeshima, Masayoshi [Reprint author]
CORPORATE SOURCE: Lab. Biochemistry, Graduate Sch. Bioagricultural Sci., Nagoya Univ., Nagoya 464-8601, Japan
SOURCE: Plant and Cell Physiology, (Sept., 1998) Vol. 39, No. 9, pp. 905-913. print.
CODEN: PCPHA5. ISSN: 0032-0781.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 5 Nov 1998

Last Updated on STN: 5 Nov 1998

L1 ANSWER 70 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Progress on the structure and function of aquaporin 1.
AB Life exists in water as universal solvent, and cells need to deal with its influx and efflux. Nature has accomplished the almost impossible, creating membrane channels with both a high flux and a high specificity for water. The first water channel was discovered in red blood cell membranes. Today known as aquaporin-1, this channel was found to be closely related to the major integral **protein** (MIP) of the eye lens. Cloning and sequencing of numerous related proteins of the MEP family revealed the widespread occurrence of such channels, suggesting an essential physiological function. Their structures hold the clues to the remarkable **water channel activity**, as well as to the arrangement of transmembrane segments in general. Recent medium-resolution three-dimensional electron microscopic studies determined a tetrameric complex with six tilted transmembrane helices per monomer. The helices within each monomer surround a central density formed by two interhelical loops implicated by mutagenesis in the water channel function. A combination of sequence analysis and assignment of the observed densities to predicted helices provides a basis for speculation on the nature of the water course through the **protein** . In particular, four highly conserved polar residues, E142-N192-N76-E17, are proposed to form a chain of key groups involved in the pathway of water flow through the channel.
ACCESSION NUMBER: 1998:296605 BIOSIS
DOCUMENT NUMBER: PREV199800296605
TITLE: Progress on the structure and function of aquaporin 1.
AUTHOR(S): Heymann, J. Bernard [Reprint author]; Agre, Peter; Engel, Andreas
CORPORATE SOURCE: M.E. Muller-Inst. Microscopic Structural Biol., Biozentrum, Univ. Basel, CH-4056 Basel, Switzerland
SOURCE: Journal of Structural Biology, (1998) Vol. 121, No. 2, pp. 191-206. print.
CODEN: JSBIEM. ISSN: 1047-8477.
DOCUMENT TYPE: Article
General Review; (Literature Review)
LANGUAGE: English
ENTRY DATE: Entered STN: 15 Jul 1998
Last Updated on STN: 15 Jul 1998

L1 ANSWER 71 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Water transport activity of the plasma membrane aquaporin PM28A is regulated by phosphorylation.
AB PM28A is a major intrinsic **protein** of the spinach leaf plasma membrane and the major phosphoprotein. Phosphorylation of PM28A is dependent in vivo on the apoplastic water potential and in vitro on submicromolar concentrations of Ca2+. Here, we demonstrate that PM28A is an aquaporin and that its **water channel activity** is regulated by phosphorylation. Wild-type and mutant forms of PM28A, in which putative phosphorylation sites had been knocked out, were expressed in Xenopus oocytes, and the resulting increase in osmotic water permeability was measured in the presence or absence of an inhibitor of **protein** kinases (K252a) or of an inhibitor of **protein** phosphatases (okadaic acid). The results indicate that the **water channel activity** of PM28A is regulated by phosphorylation of two serine residues, Ser-115 in the first cytoplasmic loop and Ser-274 in the C-terminal region. Labeling of spinach leaves with 32p-orthophosphate and subsequent sequencing of PM28A-derived peptides demonstrated that Ser-274 is phosphorylated in vivo, whereas phosphorylation of Ser-115, a residue conserved among all plant plasma membrane aquaporins, could not be demonstrated. This identifies Ser-274 of PM28A as the amino acid residue being phosphorylated in vivo in response to increasing apoplastic water potential and

dephosphorylated in response to decreasing water potential. Taken together, our results suggest an active role for PM28A in maintaining cellular water balance.

ACCESSION NUMBER: 1998:186359 BIOSIS
DOCUMENT NUMBER: PREV199800186359
TITLE: Water transport activity of the plasma membrane aquaporin PM28A is regulated by phosphorylation.
AUTHOR(S): Johansson, Ingela; Karlsson, Maria; Shukla, Vipula K.; Chrispeels, Maarten J.; Larsson, Christer; Kjellbom, Per [Reprint author]
CORPORATE SOURCE: Dep. Plant Biochem., Lund Univ., PO Box 117, SE-221 00 Lund, Sweden
SOURCE: Plant Cell, (March, 1998) Vol. 10, No. 3, pp. 451-459. print.
CODEN: PLCEEW. ISSN: 1040-4651.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 20 Apr 1998
Last Updated on STN: 20 Apr 1998

L1 ANSWER 72 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Regulation of aquaporin-4 water channels by phorbol ester-dependent **protein** phosphorylation.
AB The molecular mechanisms for regulating water balance in many tissues are unknown. Like the kidney, the eye contains multiple water channel proteins (aquaporins) that transport water through membranes, including two (AQP1 and AQP4) in the ciliary body, the site of aqueous humor production. However, because humans with defective AQP1 are phenotypically normal and because the ocular application of phorbol esters reduce intraocular pressure, we postulated that the **water channel activity** of AQP4 may be regulated by these agents. We now report that **protein** kinase C activators, phorbol 12,13-dibutyrate, and phorbol 12-myristate 13-acetate strongly stimulate the phosphorylation of AQP4 and inhibit its activity in a dose-dependent manner. Phorbol 12,13-dibutyrate (10 muM) and phorbol 12-myristate 13-acetate (10 nM) reduced the rate of AQP4-expressing oocyte swelling by 87 and 92%, respectively. Further, phorbol 12,13-dibutyrate significantly increased the amount of phosphorylated AQP4. These results demonstrate that **protein** kinase C can regulate the activity of AQP4 through a mechanism involving **protein** phosphorylation. Moreover, they suggest important potential roles for AQP4 in several clinical disorders involving rapid water transport such as glaucoma, brain edema, and swelling of premature infant lungs.

ACCESSION NUMBER: 1998:177322 BIOSIS
DOCUMENT NUMBER: PREV199800177322
TITLE: Regulation of aquaporin-4 water channels by phorbol ester-dependent **protein** phosphorylation.
AUTHOR(S): Han, Zhiqiang; Wax, Martin B.; Patil, Rajkumar V. [Reprint author]
CORPORATE SOURCE: Dep. Ophthalmol. Visual Sci., Washington Univ. Sch. Med., 660 South Euclid, St. Louis, MO 63110, USA
SOURCE: Journal of Biological Chemistry, (March 13, 1998) Vol. 273, No. 11, pp. 6001-6004. print.
CODEN: JBCHA3. ISSN: 0021-9258.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 20 Apr 1998
Last Updated on STN: 20 Apr 1998

L1 ANSWER 73 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AB Aquaporin 1 (AQP1), a six-transmembrane domain **protein** that functions as a water channel, is present in many fluid secreting and

absorbing tissues such as kidney, brain, heart, and eye. It is believed that among the five known mammalian aquaporins, kidney aquaporin (AQP2) is the only water channel that is regulated by arginine vasopressin (AVP). The present data suggest that AQP1 may also be regulated by AVP. The application of AVP to Xenopus oocytes injected with AQP1 cRNA increased the membrane permeability to water. In addition, our data reveal that atrial natriuretic peptide (ANP), a peptide hormone that plays an important role in the regulation of body fluid homeostasis, blocks the AQP1-mediated increase in water permeability. Incubation with 8-bromo-cAMP or direct 8-bromo-cAMP injection into oocytes expressing AQP1 cRNA significantly increased membrane permeability to water, suggesting that stimulation of AQP1 activity by AVP may involve a cAMP-dependent mechanism. Regulation of water permeability by AVP and ANP has potential relevance to active water transport in a variety of tissues that express AQP1 including kidney, brain, and eye.

ACCESSION NUMBER: 1997:482727 BIOSIS
DOCUMENT NUMBER: PREV199799781930
TITLE: Regulation of **water channel activity** of aquaporin 1 by arginine vasopressin and atrial natriuretic peptide.
AUTHOR(S): Patil, Rajkumar V. [Reprint author]; Han, Zhiquang; Wax, Martin B.
CORPORATE SOURCE: Dep. Ophthalmol. Visual Sci., Washington Univ. Sch. Med., 660 South Euclid, St. Louis, MO 63110, USA
SOURCE: Biochemical and Biophysical Research Communications, (1997) Vol. 238, No. 2, pp. 392-396.
CODEN: BBRCA9. ISSN: 0006-291X.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 7 Nov 1997
Last Updated on STN: 7 Nov 1997

L1 ANSWER 74 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Function and regulation of seed aquaporins.
AB The discovery of water channel proteins named aquaporins has shed new light on the molecular mechanisms of transmembrane water transport in higher plants. As with their animal counterparts, plant aquaporins belong to the large MIP family of transmembrane channels. An increasing number of aquaporins is now being identified on both the vacuolar and plasma membranes of plant cells, but their integrated function remains unclear. Aquaporin alpha-TIP is specifically expressed in the membrane of **protein** storage vacuoles in seeds of many plant species. alpha-TIP was previously shown to undergo phosphorylation in bean seeds. The functional significance of this process was further investigated after heterologous expression of the **protein** in Xenopus oocytes. Using site-directed mutagenesis of alpha-TIP and in vitro and in vivo phosphorylation by animal cAMP-dependent **protein** kinase, it is shown that, in oocytes, direct phosphorylation of alpha-TIP occurs at three distinct sites and stimulates its **water channel activity**. In addition to aquaporin phosphorylation, other mechanisms that target aquaporin function are used by living cells to regulate their membrane water permeability. These are the fine control of aquaporin gene expression and, in animal cells only, the regulated trafficking of water channel-containing vesicles. The present work and studies by others on the phosphorylation of nodulin-26, an ion channel **protein** homologous to alpha-TIP, provide novel insights into the mechanisms of plant membrane **protein** regulation. These studies might help identifying and characterizing novel membrane-bound **protein** kinases and phosphatases. Finally, an integrated function for seed vacuolar aquaporins is discussed. During germination, the rehydration of seed cells, the drastic changes in vacuole morphology, the breakdown and the mobilization of storage products from the vacuole may create osmotic perturbations in the cytoplasm. The fine tuning of TIP aquaporin activity may help control the kinetics and amplitude of osmotic

water flows across the tonoplast to achieve proper cytoplasm osmoregulation and control of vacuolar volume.

ACCESSION NUMBER: 1997:292860 BIOSIS
DOCUMENT NUMBER: PREV199799592063
TITLE: Function and regulation of seed aquaporins.
AUTHOR(S): Maurel, Christophe [Reprint author]; Chrispeels, Maarten; Lurin, Claire; Tacnet, Frederique; Geelen, Danny; Ripoche, Pierre; Guern, Jean
CORPORATE SOURCE: Inst. Sciences Vegetales, CNRS, Avenue Terrasse, F-91198 Gif-sur-Yvette, France
SOURCE: Journal of Experimental Botany, (1997) Vol. 48, No. SPEC. ISSUE, pp. 421-430.
CODEN: JEBOA6. ISSN: 0022-0957.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 9 Jul 1997
Last Updated on STN: 9 Jul 1997

L1 ANSWER 75 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AB Aquaporin-3 (AQP3) is unique in its structure (lowest homology with other aquaporins) and in its function (significantly conductive to both small nonelectrolytes and water). However, there is a controversy among researchers on its water transport and induction by dehydration. We examined its localization and the effect of dehydration on its expression in the kidney, as well as its **water channel activity** when expressed in Xenopus oocytes. In vitro translation using reticulocyte lysate revealed that the size of rat AQP3 was 26 kDa, and the band shifted to around 31 kDa with microsomal fraction, which was sensitive to the digestion with N-glycosidase F. In Western blot analysis of rat kidney medulla, AQP3 appeared as a sharp band at 27 kDa and a broad band at 34-40 kDa. In immunohistochemistry, AQP3 was localized to principal cells and absent in intercalated cells in outer medulla. In inner medulla, AQP3 was restricted to inner medullary collecting duct (IMCD) cells. AQP3 was confined to the basolateral membrane of these cells. Although dehydration of rats for 2 days did not change the distribution pattern of AQP3 in IMCD cells, the dehydration increased AQP3 mRNA by twofold with slight increase of its **protein** level in kidney medulla. Finally, we confirmed its **water channel activity** when expressed in Xenopus oocytes. The human AQP3 stimulated osmotic water permeability by eightfold, which was inhibited by 0.3 mM mercury chloride by 34% and reversed by beta-mercaptoethanol. Our results indicate that AQP3 is a glycosylated **protein** and a mercury-sensitive water channel localized at the basolateral membrane of principal cells and IMCD cells, and its expression is induced by dehydration at both **protein** and mRNA level.

ACCESSION NUMBER: 1997:173867 BIOSIS
DOCUMENT NUMBER: PREV199799480470
TITLE: Immunolocalization and effect of dehydration on AQP3, a basolateral water channel of kidney collecting ducts.
AUTHOR(S): Ishibashi, Kenichi [Reprint author]; Sasaki, Sei; Fushimi, Kiyohide; Yamamoto, Tadashi; Kuwahara, Michio; Marumo, Fumiaki
CORPORATE SOURCE: Second Dep. Intern. Med., Tokyo Med. Dental Univ., 1-5-45 Yushima, Bunkyo, Tokyo 113, Japan
SOURCE: American Journal of Physiology, (1997) Vol. 272, No. 2 PART 2, pp. F235-F241.
CODEN: AJPHAP. ISSN: 0002-9513.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 24 Apr 1997
Last Updated on STN: 24 Apr 1997

L1 ANSWER 76 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Characterization of a new vacuolar membrane aquaporin sensitive to mercury at a unique site.
AB The membranes of plant and animal cells contain aquaporins, proteins that facilitate the transport of water. In plants, aquaporins are found in the vacuolar membrane (tonoplast) and the plasma membrane. Many aquaporins are mercury sensitive, and in AQP1, a mercury-sensitive cysteine residue (Cys-189) is present adjacent to a conserved Asn-Pro-Ala motif. Here, we report the molecular analysis of a new Arabidopsis aquaporin, delta-TIP (for tonoplast intrinsic **protein**), and show that it is located in the tonoplast. The **water channel activity** of delta-TIP is sensitive to mercury. However, the mercury-sensitive cysteine residue found in mammalian aquaporins is not present in delta-TIP or in gamma-TIP, a previously characterized mercury-sensitive tonoplast aquaporin. Site-directed mutagenesis was used to identity the mercury-sensitive site in these two aquaporins as Cys-116 and Cys-118 for delta-TIP and gamma-TIP, respectively. These mutations are at a conserved position in a presumed membrane-spanning domain not previously known to have a role in aquaporin mercury sensitivity. Comparing the tissue expression patterns of delta-TIP with gamma-TIP and alpha-TIP showed that the TIPs are differentially expressed.
ACCESSION NUMBER: 1996:289833 BIOSIS
DOCUMENT NUMBER: PREV199699012189
TITLE: Characterization of a new vacuolar membrane aquaporin sensitive to mercury at a unique site.
AUTHOR(S): Daniels, Mark J.; Chaumont, Francois; Mirkov, T. Erik; Chrispeels, Maarten J. [Reprint author]
CORPORATE SOURCE: Dep. Biol., Univ. California San Diego, La Jolla, CA 92093-0116, USA
SOURCE: Plant Cell, (1996) Vol. 8, No. 4, pp. 587-599. CODEN: PLCEEW. ISSN: 1040-4651.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 25 Jun 1996
Last Updated on STN: 25 Jun 1996

L1 ANSWER 77 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin alpha-TIP.
AB The vacuolar membrane **protein** alpha-TIP is a seed-specific **protein** of the Major Intrinsic **Protein** family. Expression of alpha-TIP in Xenopus oocytes confered a 4- to 8-fold increase in the osmotic water permeability (Pf) of the oocyte plasma membrane, showing that alpha-TIP forms water channels and is thus a new aquaporin. alpha-TIP has three putative phosphorylation sites on the cytoplasmic side of the membrane (Ser7, Ser23 and Ser99), one of which (Ser7) has been shown to be phosphorylated. We present several lines of evidence that the activity of this aquaporin is regulated by phosphorylation. First, mutation of the putative phosphorylation sites in alpha-TIP (Ser7Ala, Ser23Ala and Ser99Ala) reduced the apparent water transport activity of alpha-TIP in oocytes, suggesting that phosphorylation of alpha-TIP occurs in the oocytes and participates in the control of **water channel activity**. Second, exposure of oocytes to the cAMP agonists 8-bromoadenosine 3',5'-cyclic monophosphate, forskolin and 3-isobutyl-1-methylxanthine, which stimulate endogenous **protein** kinase A (PKA), increased the water transport activity of cc-TIP by 80-100% after 60 min. That the **protein** can be phosphorylated by PKA was demonstrated by phosphorylating alpha-TIP in isolated oocyte membranes with the bovine PKA catalytic subunit. Third, the integrity of the three sites at positions 7, 23 and 99 was necessary for the cAMP-dependent increase in the Pf of oocytes expressing alpha-TIP, as well as for in vitro phosphorylation of alpha-TIP. These findings demonstrate that the alpha-TIP water channel can be modulated via phosphorylation of Ser7, Ser23 and Ser99. To our knowledge, this is the

first evidence of aquaporin regulation via phosphorylation and we propose this process as a mechanism for regulating water permeability of biological membranes.

ACCESSION NUMBER: 1995:387245 BIOSIS
DOCUMENT NUMBER: PREV199598401545
TITLE: Phosphorylation regulates the **water channel activity** of the seed-specific aquaporin alpha-TIP.
AUTHOR(S): Maurel, Christophe [Reprint author]; Kado, Raymond T.; Guern, Jean; Chrispeels, Maarten J.
CORPORATE SOURCE: Inst. Sci. Vegetales, CNRS, F-91198 Gif-sur-yvette Cedex, France
SOURCE: EMBO (European Molecular Biology Organization) Journal, (1995) Vol. 14, No. 13, pp. 3028-3035.
CODEN: EMJODG. ISSN: 0261-4189.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 13 Sep 1995
Last Updated on STN: 13 Sep 1995

L1 ANSWER 78 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI Concurrent expression of erythroid and renal aquaporin CHIP and appearance of **water channel activity** in perinatal rats.
AB Major phenotypic changes occur in red cell membranes during the perinatal period, but the underlying molecular explanations remain poorly defined. Aquaporin CHIP, the major erythroid and renal water channel, was studied in perinatal rats using affinity-purified anti-CHIP IgG for immunoblotting, flow cytometry, and immunofluorescence microscopy. CHIP was not detected in prenatal red cells but was first identified in circulating red cells on the third postnatal day. Most circulating red cells were positive for CHIP by the seventh postnatal day, and this proportion rose to nearly 100% by the 14th day. The ontogeny of red cell CHIP correlated directly with acquisition of osmotic water permeability and inversely with Arrhenius activation energy. Only minor alterations in the composition of red cell membrane lipids occurred at this time. Immunohistochemical analysis of perinatal kidneys demonstrated a major induction of CHIP in renal proximal tubules and descending thin limbs at birth, coincident with the development of renal concentration mechanisms. Therefore, water channels are unnecessary for oxygen delivery or survival in the prenatal circulation, however CHIP may confer red cells with the ability to rehydrate rapidly after traversing the renal medulla, which becomes hypertonic after birth.

ACCESSION NUMBER: 1993:582853 BIOSIS
DOCUMENT NUMBER: PREV199497002223
TITLE: Concurrent expression of erythroid and renal aquaporin CHIP and appearance of **water channel activity** in perinatal rats.
AUTHOR(S): Smith, Barbaral.; Baumgarten, Ruben; Nielsen, Soren; Raben, Daniel; Zeidel, Mark L.; Agre, Peter [Reprint author]
CORPORATE SOURCE: Johns Hopkins Univ. Sch. Med., 725 North Wolfe Street, Baltimore, MD, USA
SOURCE: Journal of Clinical Investigation, (1993) Vol. 92, No. 4, pp. 2035-2041.
CODEN: JCINAO. ISSN: 0021-9738.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 28 Dec 1993
Last Updated on STN: 28 Dec 1993

L1 ANSWER 79 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI The mercury-sensitive residue at cysteine-189 in the CHIP28 water channel.
AB Water channels provide the plasma membranes of red cells and renal proximal tubules with high permeability to water, thereby permitting water to move in the direction of an osmotic gradient. Molecular identification

of CHIP28 **protein** as the membrane water channel was first accomplished by measurement of osmotic swelling of Xenopus oocytes injected with CHIP28 RNA (Preston, G. M., Carroll, T. P., Guggino, W. B., and Agre, P. (1992) Science 256, 385-387). Since water channels are pharmacologically inhibited by submillimolar concentrations of Hg-2+, site-directed mutagenesis was undertaken to demonstrate which of the 4 cysteines (87, 102, 152, or 189) is the Hg-2+-sensitive residue in the CHIP28 molecule. Each cysteine was individually replaced by serine, and oocytes expressing each of the four mutants exhibited osmotic water permeability (P-f) equivalent to wild-type CHIP28. After incubation in HgCl-2, all were significantly inhibited, except C189S which was not inhibited even at 3 mM HgCl-2. CHIP28 exists as a multisubunit complex in the native membrane; however, although oocytes injected with mixed CHIP28 and C189S RNAs exhibited P-f corresponding to the sum of their individual activities, exposure to Hg-2+ only reduced the P-f to the level of the C189S mutant. Of the six substitutions at residue 189, only the serine and alanine mutants exhibited increased P-f and had glycosylation patterns resembling wild-type CHIP28 on immunoblots. These studies demonstrated: (i) CHIP28 **water channel activity** is retained despite substitution of individual cysteines with serine; (ii) cysteine 189 is the Hg-2+-sensitive residue; (iii) the subunits of the CHIP28 complex are individually active water pores; (iv) residue 189 is critical to proper processing of the CHIP28 **protein**.

ACCESSION NUMBER: 1993:115524 BIOSIS
DOCUMENT NUMBER: PREV199395059624
TITLE: The mercury-sensitive residue at cysteine-189 in the CHIP28 water channel.
AUTHOR(S): Preston, Gregory M.; Jung, Jin Sup; Guggino, William B.; Agre, Peter [Reprint author]
CORPORATE SOURCE: Hunterian 103, Johns Hopkins Univ. Sch. Med., 725 N. Wolfe St., Baltimore, Md. 21205, USA
SOURCE: Journal of Biological Chemistry, (1993) Vol. 268, No. 1, pp. 17-20.
CODEN: JBCHA3. ISSN: 0021-9258.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 27 Feb 1993
Last Updated on STN: 28 Feb 1993

L1 ANSWER 80 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI A 30 KDA FUNCTIONAL SIZE FOR THE ERYTHROCYTE WATER CHANNEL DETERMINED IN-SITU BY RADIATION INACTIVATION.
AB The functional unit size of the water channel in rabbit erythrocytes was assessed using target size analysis following radiation inactivation. Using Radiochromic nylon dosimetry, accurate values of accumulated dose yielded an absolute target analysis, leading to direct determination of molecular size. The erythrocyte water channel functional size was shown to be 30 kDa, and is identical to the size found in rat renal proximal tubule brush border membranes (1), suggesting close homology of these two water channels. The result suggests that the 28 kDa channel-like intrinsic **protein** (CHIP28) recently isolated from human erythrocytes and proximal tubule (2), which is believed to form water channels of oligomeric construction may have a functional **water channel activity** in monomeric form.

ACCESSION NUMBER: 1992:343594 BIOSIS
DOCUMENT NUMBER: PREV199294035819; BA94:35819
TITLE: A 30 KDA FUNCTIONAL SIZE FOR THE ERYTHROCYTE WATER CHANNEL DETERMINED IN-SITU BY RADIATION INACTIVATION.
AUTHOR(S): VAN HOEK A N [Reprint author]; LUTHJENS L H; HOM M L; VAN OS C H; DEMPSTER J A
CORPORATE SOURCE: DEP PHYSIOL, UNIV NIJMEGEN, PO BOX 9101, 6500 HB NIJMEGEN, NETH
SOURCE: Biochemical and Biophysical Research Communications, (1992) Vol. 184, No. 3, pp. 1331-1338.

CODEN: BBRCA9. ISSN: 0006-291X.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: ENGLISH
ENTRY DATE: Entered STN: 29 Jul 1992
Last Updated on STN: 29 Jul 1992

L1 ANSWER 81 OF 81 BIOSIS COPYRIGHT 2004 BIOLOGICAL ABSTRACTS INC. on STN
TI ROLE OF GLUCOSE CARRIER IN HUMAN ERYTHROCYTE WATER PERMEABILITY.
AB Although the transport properties of human erythrocyte water channels have been well characterized, the identity of the **protein**(s) mediating water flow remains unclear. Recent evidence that glucose carriers can conduct water raised the possibility that the glucose carrier, which is abundant in human erythrocytes, is the water channel. To test this possibility, water permeabilities and glucose fluxes were measured in large unilamellar vesicles (LUV) containing human erythrocyte lipid alone (lipid LUV), reconstituted purified human erythrocyte glucose carrier (Glut 1 LUV), or reconstituted glucose carrier in the presence of other human erythrocyte ghost proteins (ghost LUV). In glucose and ghost LUV, glucose carriers were present at 25% of the density of native erythrocytes, were oriented randomly in the bilayer, and exhibited characteristic inhibition of glucose flux when exposed to cytochalasin B. Osmotic water permeability (Pf, in centimeters per second; n = 4) averaged 0.0012 ± 0.00033 in lipid LUV, 0.0032 ± 0.0015 in Glut1 LUV, and 0.006 ± 0.0014 in ghost LUV. Activation energies of water flow for the three preparations ranged between 10 and 13 kcal/mol; p-(chloromercuri)benzenesulfonate (pCMBS), and organic mercurial inhibitor of erythrocyte water channels, and cytochalasin B did not alter Pf. These results indicate the reconstitution of glucose carriers at high density increases water permeability but does not result in **water channel activity**. However, because the turnover number of reconstituted carriers is reduced from that of native carriers, experiments were also performed on erythrocyte ghosts with intact water channel function. In ghosts, Pf averaged 0.038 ± 0.013 (n = 9), while the activation energy for water flow averaged 3.0 ± 0.3 kcal/mol. Mercuric chloride reduced Pf by 93%, while pCMBS reduced it by 69%. Thus, ghosts retained water channel function. Preparation of ghosts in the presence of calcium led to markedly reduced glucose carrier activity without altering Pf. In addition, cytochalasin B did not reduce Pf. We conclude that the erythrocyte glucose carrier is not the water channel. The identity of the erythrocyte water channel remains elusive.
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DOCUMENT NUMBER: PREV199293084587; BA93:84587
TITLE: ROLE OF GLUCOSE CARRIER IN HUMAN ERYTHROCYTE WATER PERMEABILITY.
AUTHOR(S): ZEIDEL M L [Reprint author]; ALBALAK A; GROSSMAN E; CARRUTHERS A
CORPORATE SOURCE: RESEARCH SERV, WEST ROXBURY VETERANS ADMINISTRATION MED CENTER, 1400 VFW PARKWAY, WEST ROXBURY, MASS 02132, USA
SOURCE: Biochemistry, (1992) Vol. 31, No. 2, pp. 589-596.
CODEN: BICHAW. ISSN: 0006-2960.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: ENGLISH
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☐ 1. Document ID: US 6632924 B2

L4: Entry 1 of 7 File: USPT Oct 14, 2003

US-PAT-NO: 6632924
DOCUMENT-IDENTIFIER: US 6632924 B2

TITLE: Method of measuring plasma membrane targeting of GLUT4

DATE-ISSUED: October 14, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bogan; Jonathan S.	Belmont	MA		
Lodish; Harvey F.	Brookline	MA		

US-CL-CURRENT: 530/350; 435/252.3, 435/325, 435/4, 435/6, 435/69.1, 435/69.7, 435/70.3

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 2. Document ID: US 6303373 B1

L4: Entry 2 of 7 File: USPT Oct 16, 2001

US-PAT-NO: 6303373
DOCUMENT-IDENTIFIER: US 6303373 B1

TITLE: Method of measuring plasma membrane targeting of GLUT4

DATE-ISSUED: October 16, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bogan; Jonathan S.	Belmont	MA		
Lodish; Harvey F.	Brookline	MA		

US-CL-CURRENT: 435/325; 435/320.1, 435/6, 435/69.1, 530/350, 536/23.1

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

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☐ 3. Document ID: US 6252046 B1

L4: Entry 3 of 7 File: USPT Jun 26, 2001

US-PAT-NO: 6252046
DOCUMENT-IDENTIFIER: US 6252046 B1

TITLE: Polypeptide having water channel activity and DNA sequence

DATE-ISSUED: June 26, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Okubo; Kousaku	Mino			JP
Kuriyama; Hiroshi	Toyonaka			JP
Mita; Shiro	Ashiya			JP
Ishida; Naruhiro	Ikoma			JP

US-CL-CURRENT: 530/350; 424/450, 435/252.3, 435/320.1, 435/325, 435/69.1, 435/71.2, 536/23.4, 536/23.5

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 4. Document ID: US 5972882 A

L4: Entry 4 of 7 File: USPT Oct 26, 1999

US-PAT-NO: 5972882
DOCUMENT-IDENTIFIER: US 5972882 A

TITLE: Treatment of polycystic kidney disease using vasopressin V.sub.2 receptor antagonists

DATE-ISSUED: October 26, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Gattone, II; Vincent H.	Overland Park	KS		

US-CL-CURRENT: 514/11

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 5. Document ID: US 5858702 A

L4: Entry 5 of 7 File: USPT Jan 12, 1999

US-PAT-NO: 5858702
DOCUMENT-IDENTIFIER: US 5858702 A

h e b b g e e e f e ef b e

TITLE: Isolation, cloning and expression of transmembrane water channel Aquaporin 5 (AQP5)

DATE-ISSUED: January 12, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Agre; Peter C.	Baltimore	MD		

US-CL-CURRENT: 435/69.1; 435/252.3, 435/320.1, 530/350, 536/23.5

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 6. Document ID: US 5741671 A

L4: Entry 6 of 7 File: USPT Apr 21, 1998

US-PAT-NO: 5741671
DOCUMENT-IDENTIFIER: US 5741671 A

TITLE: Isolation cloning and expression of transmembrane water channel aquaporin 1 (AQP1)

DATE-ISSUED: April 21, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Agre; Peter C.	Baltimore	MD		

US-CL-CURRENT: 435/69.1; 435/320.1, 435/325, 536/23.5

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 7. Document ID: US 5448301 A

L4: Entry 7 of 7 File: USPT Sep 5, 1995

US-PAT-NO: 5448301
DOCUMENT-IDENTIFIER: US 5448301 A

TITLE: Programmable video transformation rendering method and apparatus

DATE-ISSUED: September 5, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Michener; James A.	Grass Valley	CA		

US-CL-CURRENT: 348/578; 348/580, 382/293

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